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The Heating and Ventilating Magazine

A Monthly Journal of Engineering Progress

XIV. No. 11.
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NOVEMBER, 1927

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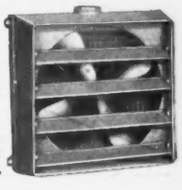

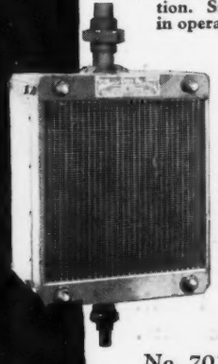

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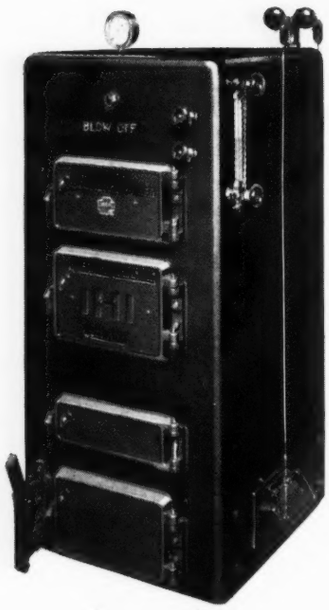

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The Heating and Ventilating Magazine

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MOST of us can remember when Service, rather than "No-Matter-How-You-Get-It, But-Get-It," became the keynote of modern business. It was during this period that the better types of "trade papers" became "business journals" and "technical magazines." Instead of trying to get by with a minimum amount of reading matter to carry the advertisements, they began to think of the reading columns as channels for serving their industries. Those who saw the vision, and acted, went on to the heights.

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The Progress of Heating and the Prevention of Heat Waste

Ninth of a Series

This Day . . . Of Overheating

HUGE, gorgeous places today—homes, clubs and public buildings—are heavy with an atmosphere of warmth that nearly stupifies. The progress of heating indeed has brought our modern day plentiful of heat. But we in turn unconsciously indulge in an over-plenty of heat: to our ill-health and discomfort, and to our greater coal consumption cost. Hand managed, temperatures of rooms rise and fall to disturbing, dangerous extremes. Hand managed, neglect as well as inaccuracy occurs. One room is excessively warm while another is excessively cold. And no room is of the temperature it should be. The Johnson System of Heat Control is therefore prominent in the progress of heating. Johnson Heat Control automatically keeps each room at the correctly comfortable temperature necessary, in accordance with the temperature and changes out-doors. And by the same automatic manner—of preventing overheating and consequent heat waste—saves enormously in fuel, as much as 40 per cent per year. . . . . .

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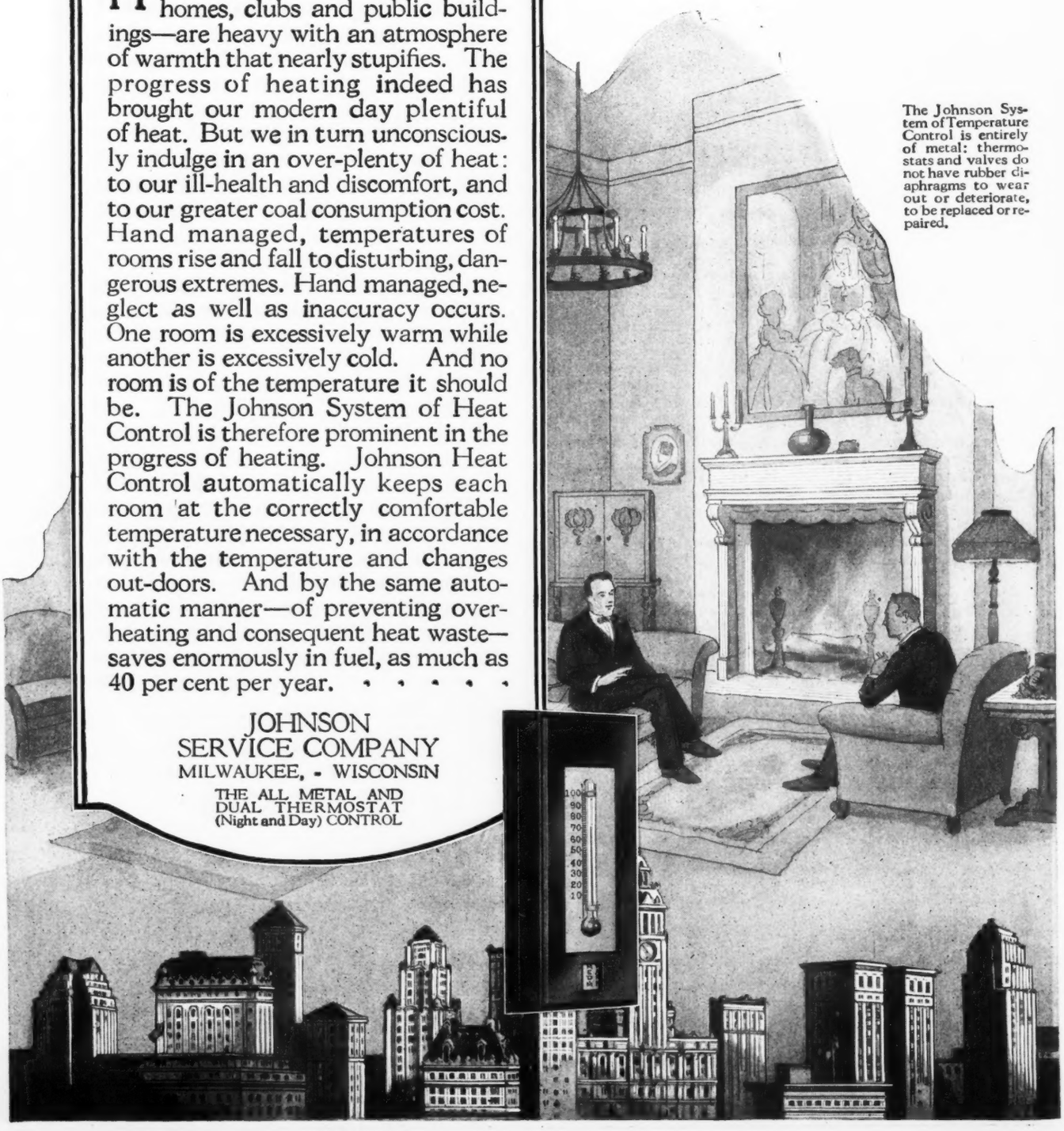

The Johnson System of Temperature Control is entirely of metal: thermostats and valves do not have rubber diaphragms to wear out or deteriorate, to be replaced or repaired.

The Heating and Ventilating Magazine

A Monthly Journal of Engineering Progress

NOVEMBER, 1927

Engineers and Contractors Agree on Steam Riser Capacities

Critical Velocities Obtained in Research Laboratory Tests Offer Basis For Figuring Capacities of Upfeed Risers For One- and Two-Pipe Systems

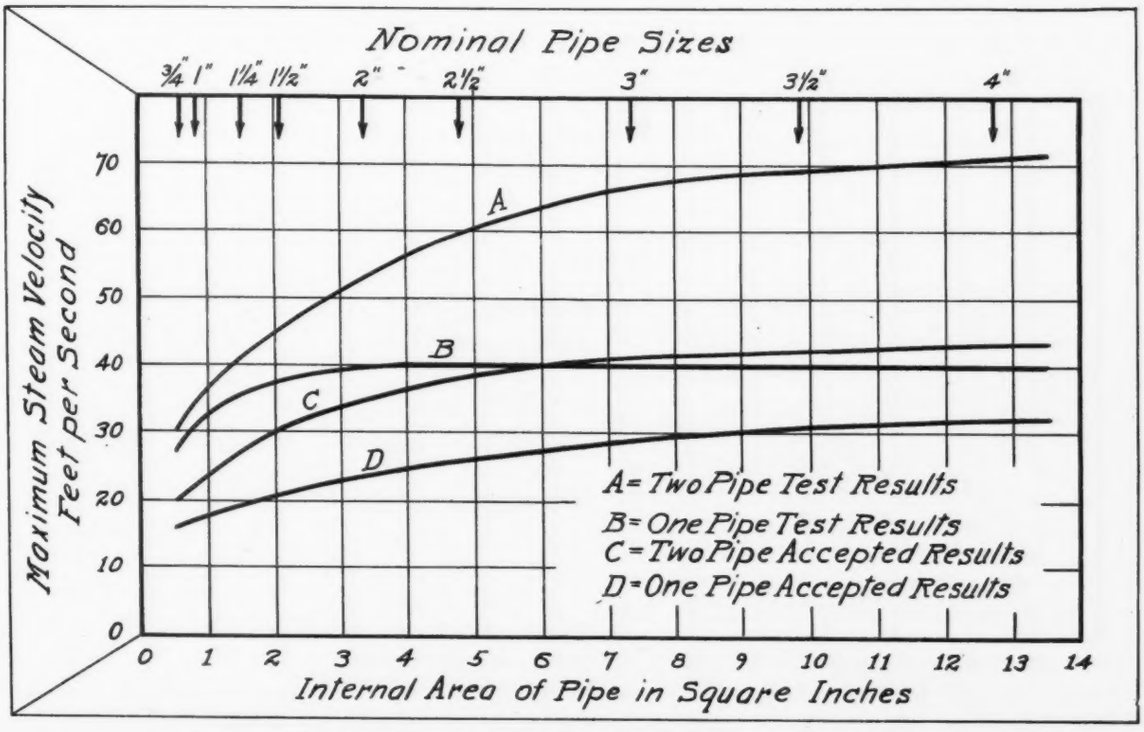

Fig. 1. Critical Velocities for One and Two-Pipe Steam Risers as Accepted for Practical Work

BASED upon the tests conducted at the American Society of Heating and Ventilating Engineers' Research Laboratory, dealing with critical velocities and their bearing on pipe sizes for steam heating systems, the interesting announcement is made that the A.S.H. & V.E. Committee on Pipe Sizes, as well as the Standardization Committee of the Heating and Piping Contractors National Association, have approved the velocities shown on the accompanying chart (Fig. 1) on which to base capacities of upfeed steam heating risers for one- and two-pipe systems. It

TABLE 1. CAPACITIES OF UP-FEED RISERS—ONE-PIPE SYSTEM

	BASED ON LABORATORY TESTS					BASED ON 1 OZ. PRESSURE DROP IN 100 FT.					
Pipe size in.	Velocity ft. per sec.	Pressure drop oz. per 100 ft.	Sq. ft. radiation	Capacity B.t.u. supplied per hr.	Lbs. steam per hr.	Velocity ft. per sec.	Pressure drop oz. per 100 ft.	Sq. ft. radiation	Capacity B.t.u. supplied per hr.	Lbs. steam per hr.	1926-7 GUIDE values sq. ft. radiation
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
¾	16	...	32	7,730	8.0	...	1.0	...	...	...	...
1	17	0.97	55	13,230	13.7	17.5	1.0	56	13,580	14.0	60
1¼	19	0.77	106	25,700	26.5	21.9	1.0	122	29,585	30.5	90
1½	20	0.66	152	36,800	38.0	25.0	1.0	190	46,075	47.5	120
2	23	0.57	288	69,800	72.0	30.9	1.0	386	93,605	96.5	210
2½	26	0.54	464	112,500	116.0	35.7	1.0	635	154,036	158.8	300
3	29	0.48	799	193,600	199.8	42.0	1.0	1162	281,785	290.5	490
3½	31	0.44	1144	277,000	286.0	47.0	1.0	1737	421,271	434.3	630
4	32	0.39	1520	368,000	380.0	51.7	1.0	2457	595,871	614.3	800

TABLE 2. CAPACITIES OF UP-FEED RISERS—TWO-PIPE SYSTEM

	BASED ON LABORATORY TESTS					BASED ON 1 OZ. PRESSURE DROP IN 100 FT.					
Pipe size in.	Velocity ft. per sec.	Pressure drop oz. per 100 ft.	Sq. ft. radiation	Capacity B.t.u. supplied per hr.	Lbs. steam per hr.	Velocity ft. per sec.	Pressure drop oz. per 100 ft.	Sq. ft. radiation	Capacity B.t.u. supplied per hr.	Lbs. steam per hr.	1926-7 GUIDE values sq. ft. radiation
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
¾	20	...	40	9,550	9.95	...	1.0	...	...	...	...
1	23	1.78	74	17,900	18.45	17.5	1.0	56	13,580	14.0	60
1¼	27	1.57	151	36,500	37.65	21.9	1.0	122	29,585	30.5	90
1½	30	1.48	228	55,200	57.0	25.0	1.0	190	46,075	47.5	120
2	35	1.33	438	106,100	109.5	30.9	1.0	386	93,605	96.5	210
2½	38	1.16	678	164,100	169.4	35.7	1.0	635	154,036	158.8	300
3	41	0.95	1129	273,500	282.2	42.0	1.0	1162	281,785	290.5	490
3½	42	0.81	1548	375,500	387.0	47.0	1.0	1737	421,271	434.3	630
4	43	0.71	2042	495,000	510.5	51.7	1.0	2457	595,871	614.3	800

will be noted in Fig. 1 that the curves for accepted velocities are given for different sizes of pipe in both one-pipe and two-pipe systems.

In commenting upon this chart, Director F. C. Houghten, of the Research Laboratory, states:

"These curves on which practical values are based show velocities lower than any attained by test in the laboratory. Analysis of the curves indicates that a fairly large factor of safety is allowed in the accepted velocity through small pipes. This is in keeping with the experience of engineers interested in the installation of pipe. The defects

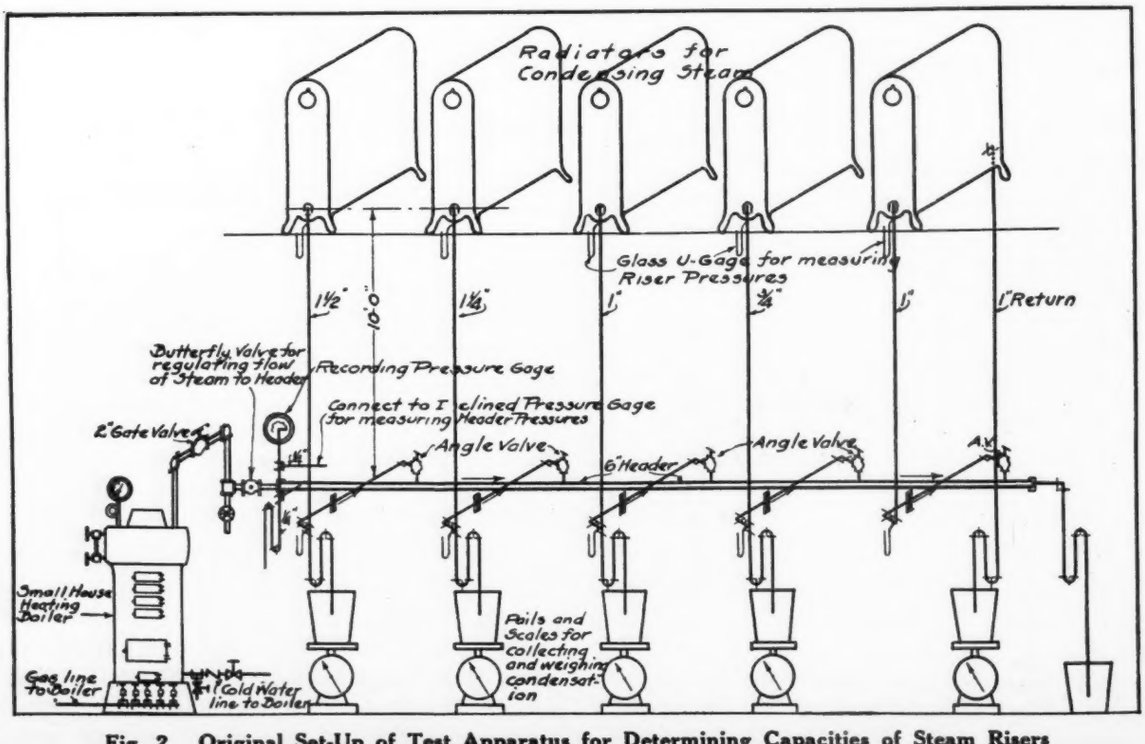

Fig. 2. Original Set-Up of Test Apparatus for Determining Capacities of Steam Risers as Affected by Critical Velocities of Condensate Mixtures

in pipe are much more likely in small sizes and have a greater percentage effect on the capacity of the pipe. Also clogging of pipe, due to corrosion or scale, is much more likely in the small sizes."

The accompanying tables prepared by the laboratory give the capacities of upfeed steam heating risers for one- and two-pipe systems, respectively. The pressure-drop for the accepted velocity is calculated from the Babcock formula, while the capacity of the pipe is given in square feet of equivalent cast-iron radiation, in B.T.U. and in pounds of steam. The figures in the last column show the capacities as given in the A.S.H. & V.E. *Guide* 1926-27.

Mr. Houghten further points out that the values presented in these tables do not include a factor of safety to cover heating-up load and condensation in the piping. It is the opinion of those consulted in arriving at a basis for the accepted tables that where the heating-up load is in excess of the normal operating load, this should be taken into account in estimating the maximum amount of steam or heat to be delivered. Likewise the estimated condensation in the riser and piping to be supplied should be added to the steam and heat requirements.

In this connection, it was pointed out, while in some cases the heating-up load may be a large factor, in most cases it is a small factor and, therefore, it would appear to be poor engineering to base all pipe sizes on a large heating-up factor which would not often be used.

"Where heating up of a building is accomplished by increasing the combustion rate in the boiler," stated Mr. Houghten, "the rate of steam delivery from the boiler, due to flow resistance in the piping system, usually will limit the rate of steam supply so that the heating up will extend over a longer period of time.

"Air valves usually are designed to limit the rate of air elimination from the radiator and, therefore, the rate of steam supply, so that here is another tendency to spread the heating-up load over a comparatively long time. Again, the demand for steam in many buildings is such that no great call is made for steam while heating up, in excess of that used when all radiation is using maximum amount of steam after the heating-up period.

"On the other hand, there are cases where the steam is supplied from a central station (a comparatively inexhaustible supply) to a building having a large demand at the same time over the entire building or section of building while heating up. In such cases the heating-up load must be given some special consideration.

"It will be noted that the capacities given in the tables require pressure-drops, in many cases, in excess of 1 oz. per 100 ft. equivalent length of run. Many engineers lay out systems with pressure-drops of 1 oz. per 100 ft. If this figure is taken as the limiting factor, then the capacities shown in Columns 9, 10 and 11 of tables 1 and 2, will be of interest."

INVESTIGATION BEGUN IN 1922

When the investigation on steam-riser capacities was started at the laboratory in 1922, the intention was to determine allowable velocities of steam with counter-flowing condensate in various parts of a heating system. It is worthy of note that when the problem was first studied, it was thought that a limiting or critical velocity would be found at approximately 16 ft. per second, above which a system would not operate satisfactorily. As a matter of fact, it was found in a later test, in a Chicago office building, that complete satisfaction was obtained with velocities at least as high as

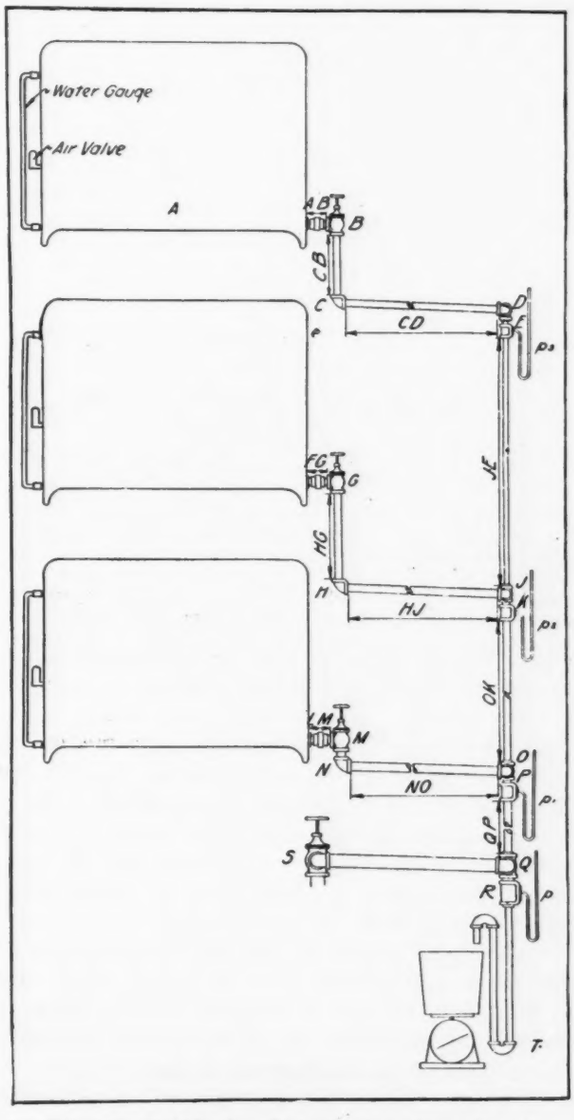

Fig. 3. Set-Up for Determining Capacity of Compound Riser

This four-story system was erected in Professor Dibble's laboratory, Carnegie Institute of Technology. It supplied steam to three levels through three sections of a riser, each approximately 10 feet in length. The riser size was 1¼ in. to the second floor, 1 in. to the third floor and ¾ in. to the fourth floor. Steam was taken from an 8-in. main through a branch connection containing a valve. Branches to the radiators were from 3 ft. to 5 ft. in length and estimated to be large enough so that steam supplied to the radiators would be limited by the riser rather than any other part of the system. During the investigation, various sizes of radiators and radiator connections were used on the different levels.

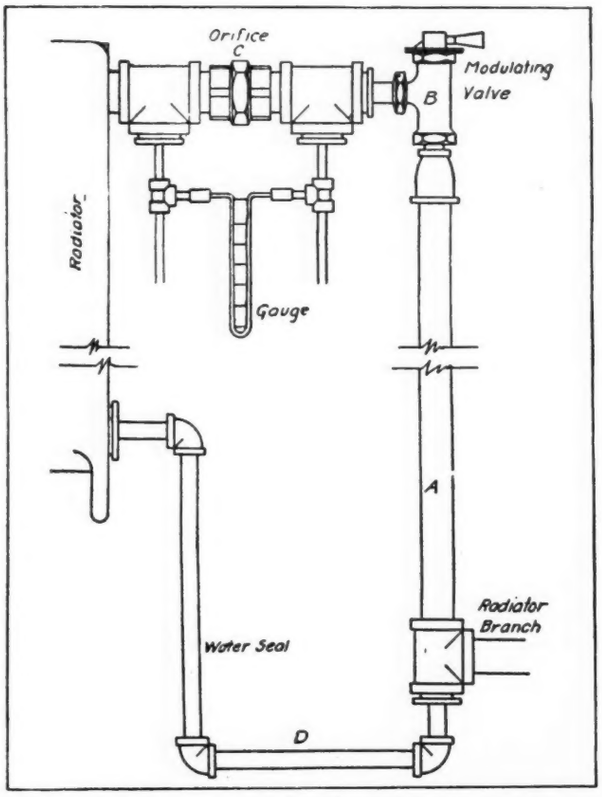

Fig. 4. Apparatus for Metering Steam to Radiators

Steam was taken from the radiator branch through a vertical pipe *A*, radiator valve *B*, and calibrated orifice *C* to the top radiator connection. The condensate from the radiator was taken from the lower radiator connection through a water-sealed trap *D* back to the radiator branch. This method of connecting the radiator to the branch is essentially a two-pipe connection. The riser and the radiator branch, however, operate purely as a one-pipe system and should not be affected in any way by the unusual connection. The calibrated orifice was conveniently used to measure the steam supplied to each level.

25.4 ft. per second, and, in one extreme case, at 36.8 ft. per second. The data, it is stated, leave little doubt that if facilities were available for further increasing radiation on the different levels, all sections of the riser would have carried steam with counter-flowing condensate at velocities between 35 ft. and 40 ft. per second.

For the early work the piping was limited to a single section up-riser or horizontal pipe under test, 10 ft. in length or shorter. This pipe was connected to the radiator with an ell, instead of the usual branch including radiator valve and other fittings. With this set-up, test data, together with visual observations of the flow of steam and the condensate in sections of glass pipe, proved conclusively that there was a very definite critical velocity above which certain disturbances occurred. This critical velocity was found to be about 25 ft. per second. Those working on the problem, however, were not at all convinced that these disturbances necessarily would limit the pipe's capacity, since in no case was it evident that they interfered with smooth and satisfactory operation of the system, even at considerably higher capacities. Again, owing to the absence of complicated interconnection of various branches and risers, there was some question regarding the possibility of recommending velocities above the critical point.

The study mentioned had extended to pipe sizes up to 1½ in. When the laboratory again investigated the problem, it was particularly emphasized that the profession needed data on large sizes for both one- and two-pipe systems.

The report from which the present conclusions have been drawn and which was presented at the summer meeting of the A.S.H. & V.E., at White Sulphur Springs, last June, covers:

1. A study in detail of the characteristics of flow in, and capacity of, different-sized sections of a four-story riser.

2. Determination of the capacity of two-story and four-story risers, ranging in size from 1½ in. to 4 in. inclusive.

3. Tests on a twelve-story riser in a heating system installed about twenty years ago and in operation since.

Some of the most interesting figures were obtained in tests made of the actual installation in the Patten Building at Sherman and Harrison Streets, Chicago. For the purpose of the test, the connection from the steam main to the pipe of the riser was changed to that shown in Fig. 6. The condensation returning from the riser was collected at A and weighed. The size of the twelve-story riser at different elevations and the radiation supplied is given in Table 3.

The radiators on the different levels were first turned off, and steam was admitted to the riser in order to determine the condensation in the riser

Fig. 5. Patten Building, Chicago

TABLE 3. DATA ON INSTALLATION IN PATTEN BUILDING, CHICAGO.

Date of test	Riser tested diam. inches	FANS No.	FANS Position floor	Remarks	Total cond. lb. per hr.	Cond. in lower sections of riser	Steam carried by riser lb. per hr.	Velocity ft. per sec.
Apr. 4	4	0			378		378	31.9
6	4	0			350		350	29.5
7	4	1	12th		437		437	36.8
		2	11th					
		2	10th					
7	4	1	12th	7th floor radiators off	369		369	31.2
		1	11th					
		1	10th					
7	4	1	12th	7th floor radiators off	335		335	28.3
		2	10th					
Apr. 5	3½	0			229	44.2	185	20.1
7	3½	1	12th	7th floor radiators off	300	44.2	256	27.8
		2	11th					
		2	10th					
7	3½	1	12th	7th floor radiators off	267	44.2	223	24.2
		1	11th					
		2	10th					
Apr. 5	3	0			203	59.4	143.6	20.8
6	3	1	12th	7th floor radiators off	236	59.4	176.0	25.6
		2	11th					
		2	10th					
7	3	1	12th	7th floor radiators off	236	59.4	176.0	25.6
		2	11th					
		2	10th					
Apr. 5	2½	0			178	75.9	52.0	11.7
6	2½	0			143	75.9	67.0	15.0
6	2½	1	12th		189	75.9	113.0	25.4
		2	11th					
6	2½	1	12th		172	75.9	96.0	21.5
		1	11th					
6	2½	1	12th		160	75.9	84.0	18.8

Note: Radiation supplied by sections of riser below that tested turned off.

and branches which was apportioned to the different sections of the riser.

The radiation on the two upper floors supplied from the 2½-in. section of the riser, was then turned on and the condensation again measured. The steam carried by the top section was obtained as the difference between the total condensate returning and that credited to the riser below the eleventh floor. In like manner the steam carried by each of the other sized sections of risers was determined. These values are given in Table 3.

Total condensation in riser 84.1 lbs. per hour. Apportioned as follows:

Riser In. Diam.	Lbs. per Hr.
2½	8.22
3	16.47
3½	15.17
4	44.24

The steam and condensate carried by the 2½-in. or topmost section of the riser was increased by directing fans against the radiators supplied by it.

The table shows that this section of riser carried 52 and 67 lbs. of steam per hour on different days, giving velocities of 11.7 and 15 ft. per second, respectively, without fans. One fan directed against one radiator increased the velocity to 18.8 ft., two fans increased it to 21.5 ft. and three fans increased it to 25.4 ft. per second. This increase

(*Continued on Page* 87)

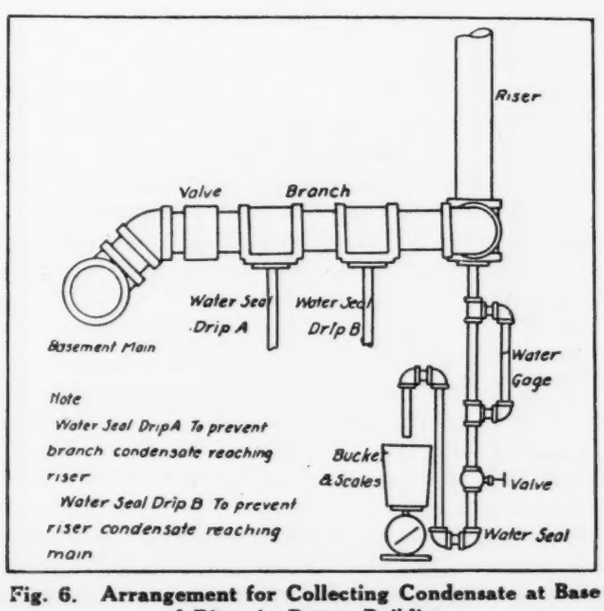

Fig. 6. Arrangement for Collecting Condensate at Base of Riser in Patten Building

Design of Heating, Ventilating and Cooling Equipment for Two Types of Theaters

II—Practical Application of Formulas and Theory to Typical Theater Without a Balcony

By Harold L. Alt

A TON of refrigeration capacity is the amount of heat necessary to melt 2000 lbs. of ice from and at 32° F. into water at the same temperature and in a period of 24 hrs. This is equal approximately to 12,000 B.T.U. per hour and the refrigeration equivalent for any amount of cooling easily can be calculated, if the work of cooling is expressed in B.T.U., by dividing the B.T.U. by 12,000.

Having determined the various sources of heat emission during the cooling process, and having the amount expressed in B.T.U., per hour, it works out that the refrigeration capacity required for the various portions of the process will be as follows:

			B.T.U.	B.T.U.		Tons of Refrigeration
(16)	Roof	(2)	154,000	/12,000	equals	12.8
	Walls, etc.	(2)	230,000	/12,000		19.2
	Body Heat	(3)	1,200,000	/12,000		100.0
	Electricity	(4)	10,000	/12,000		0.8
	Cooling Fresh Air	(10)	976,000	/12,000		81.3
	Dehumidifying Fresh Air	(12)	765,000	/12,000		63.7
	Respiration	(15)	238,000	/12,000		19.8
	Total Refrigeration Capacity, tons					297.6

Owing to the fact that some of the factors are taken a little higher than the figures often used, it is probable that a 275-ton plant would be sufficient for this building. The arbitrary rule-of-thumb that the refrigeration will roughly be equal to 70 tons per 1000 occupants will not hold in this case, owing to the large proportion of wall and roof to the number of occupants, due to the omission of the balcony.

COOLING TOWER SIZE

Just what a cooling tower will do in the particular locality where the theater may be located will vary somewhat with the wind, humidity, exposure and type of tower. For the purposes of this article it will be assumed that the cooling tower will give an average difference in temperature between the supply water and the cooled water of 7½° F. So that if a 275-ton plant is decided upon, according to the requirements as shown by the calculations (16), then the total cooling to be done will be

(17) 275 × 12,000 B.T.U., or 3,300,000 B.T.U. per hour, which, reduced to the number of B.T.U. per minute, is

(18) 3,300,000/60, or 55,000 B.T.U. per minute.

If the water cools 7½° F. in the tower, every pound of water circulated will carry off 7½ B.T.U. in raising it from the discharge water temperature of the tower up to the inlet temperature again; this is because 1 lb. of water raised 1° F. requires 1 B.T.U., and raised 7½° will take 7½ B.T.U. So, if the B.T.U. per minute is divided by the B.T.U. absorbed per pound of water, the result will be the number of pounds of water necessary to be circulated per minute. Then

(19) 55,000 B.T.U./7½ B.T.U. equals 7333 lbs.

Reducing the pounds to gallons at 8-1/3 lbs. to a gallon we have

(20) 7,333/8-1/3, or 880 g.p.m. to be circulated.

Cooling towers often are rated in gallons per minute so that in this case a 900-gal. tower would be adequate with 7½° F. drop in the water temperature. One make of tower for this rating is 66 ft. long x 19 ft. wide x 30 ft. high and has a weight, exclusive of the water contained, of 112,000 lbs. The water amounts to 38,000 lbs. additional, making the total load about 150,000 lbs. Such data as given above must be obtained from the cooling tower manufacturer as it will vary for different types of tower.

PUMPS FOR COOLING TOWER

In order to operate the cooling tower the water must be pumped to the top and allowed to drip down through the tower so that both "cooling" and "cooling by evaporation" take place during the fall. In order to get this water to the top of the tower it must be pumped, and the head on the pump will be much less if the refrigeration apparatus and circulating pumps are placed directly under the tower than if they are located in the basement, as sometimes is done. This is for the reason that, if set directly under the tower, the head will be only about 40 ft., while, if set in the basement, the head will be 40 ft. plus the height of the building, whatever it may be.

In this case we will assume that the pumps are set in the most advantageous position, just under the tower, and that the head will be the height of the tower (30 ft.), plus about 10 ft. for the distance from the bottom of the tower to the pump, plus another 10 ft. for pipe friction, or 50 ft. friction-head as a total.

REFRIGERATION MACHINERY

Just what units would be installed to supply the refrigeration requirements is a matter for the designer to decide; some would use only one, some possibly two units, and probably no one would use over three. If one unit is used, of course it would have to be of 275 tons capacity, while, if two units were selected, one might be of 175 tons and the other of 100 tons; with three units, the sizes could be made two of 100 tons and one of 75 tons, or one of 50 tons, one of 75 tons and one of 150 tons. In selecting the refrigeration apparatus compressors employing ammonia as a refrigerating medium should be avoided, owing to the danger of having the ammonia fumes escape and get into the theater in case of accident. In dividing up the refrigeration apparatus into more than one unit, it is advisable to have each unit complete in itself; that is, have the compressor, condenser and tower circulating pump so that each unit may be run individually and separately without operating the auxiliaries of the other units.

VENTILATING FAN

In the preceding article it was calculated (8) that the amount of air required for cooling will be about 117,000 c.f.m. For winter ventilation, if 20 c.f.m. per occupant is used, the amount of air required for ventilation will be

(21) 3000×20 equals 60,000 c.f.m.

and this is about one-half the amount of air used for cooling. If the fan capacity is divided between two equal-sized fans, as illustrated in Fig. 5, then both fans may be operated in the summer time and only one fan in the winter time—or one fan may be used as a supply fan, and the other fan as an exhaust fan in the winter.

It will be found, for example, that a Sturtevant No. 12 fan, double width and double inlet, when operated at 200 r.p.m., will give about 68,000 c.f.m. at 1¼-in. static pressure, when run as a cooling supply in the summer and, if operated at 165 r.p.m., will give 39,000 c.f.m. at ⅝-in. static pressure for operation as an exhaust fan during the winter. In the first case, motors of 30 H.P. to 35 H.P. will be required, as the brake horsepower of the fan is 23 H.P. In the second arrangement the brake horsepower will be only 18.4 H.P. so no difficulty will be experienced here if speed control is provided so as to reduce the fan speed from 200 r.p.m. to 165 r.p.m.

SELECTING THE HEATERS

Two main considerations enter into the selection of the heaters, *cost* and *weight*. Where apparatus is to be placed on or near the roof the loads should be kept down to the smallest amount possible, as all such loading must be supported on the building construction at increased expense; at the same time, the cooling tower and refrigeration machinery relatively is so much heavier than the heaters that the type of heater selected may make little difference in the cost of supporting the whole apparatus.

Therefore, the use of two types of heating surface will be considered: first, a cast-iron type such as Vento, and, second, a light-weight extended-surface type such as Aerofin.

With the cast-iron type of heater it is necessary to consider winter operation only, which involves 60,000 c.f.m. As it may be desired to run one apparatus without the other, this means that either apparatus should be able to heat 60,000 c.f.m. from a minimum outside temperature of zero to an inside temperature of at least 70° F.

CAST-IRON HEATERS

A preliminary survey of the cast-iron heater situation, compared with standard-dimension air washers, shows that the heater is likely to work out considerably wider than the air washer and, as good designing calls for as little variation between the heater and air-washer sizes as possible, it will be endeavored to overcome this undesirable width, as far as possible, by using more rows, of greater spacing and higher velocity. If fewer rows, closer spacing and lower velocities are considered, the result is to increase the area necessary across the face of the heater which, of course, means a higher and wider heater.

Assuming a velocity through the heater of 1600 f.p.m. and with 60,000 c.f.m. of air to pass through the heater, the free area of the heater must be

(22) 60,0000/1600, or about 38 sq. ft.

Using four rows of standard-width heater on 5⅜-in. centers, with an initial entering temperature of zero, will give a final temperature of 77° F., which is quite high enough.

Reference to the tables of free areas for Vento

heaters shows that stacks on 5⅜-in. centers and 22 sections wide will have a total width of 118 in., plus 2½ in. for staggering, making the overall width of 120½ in. The casing going over the outside of the stack, and which connects the stack to the air washer, will be about 2 in. or 3 in. wider, making the casing dimension about 123½ in. (10 ft. 3½ in.) in a horizontal direction. Now the horizontal width of the air washer suitable for this quantity of air is 10 ft. 7 in., so, if the height works out fairly well, this may be taken as a reasonably good design.

Referring again to the air washer under consideration, it is found that the height is 13 ft. 1¾ in., of which 16 in. constitutes the pan and the balance, or about 11 ft. 10 in., constitutes the opening. Therefore, the total height of the heater should approximate 12 ft., including the by-pass under the heater or a part of the by-pass, at least.

If 60-in Vento sections are used for the bottom row and 50-in. Vento sections for the top row, the total height of the heater will be about 110 in. (9 ft. 2 in.), leaving 2 ft. 10 in. for a by-pass with the top of the heater set on the same level as the top of the air washer and the bottom of the by-pass on practically the same level as the bottom of the opening into the air washer. The free area for the 60-in. row of 22 sections on 5⅜-in. spacing is given in the free area tables, as well as for the upper row of 50-in. sections, these being as follows:

(23) 22 sec. 60-in. 5⅜-in. centers...23.78 sq. ft.
22 sec. 50-in. 5⅜-in. centers...19. 85 sq. ft.

Total free area per row .....43.63 sq. ft.

In calculations (22) already made it has been shown that 38 sq. ft. is sufficient so that this arrangement, as far as free area and temperature rise are concerned, can be taken as satisfactory. The width and height already have been arranged to suit the air washer and nothing remains to be done except to decide how the rows shall be arranged in regard to the air washer; that is, how many shall be placed in front of the washer and how many after the washer.

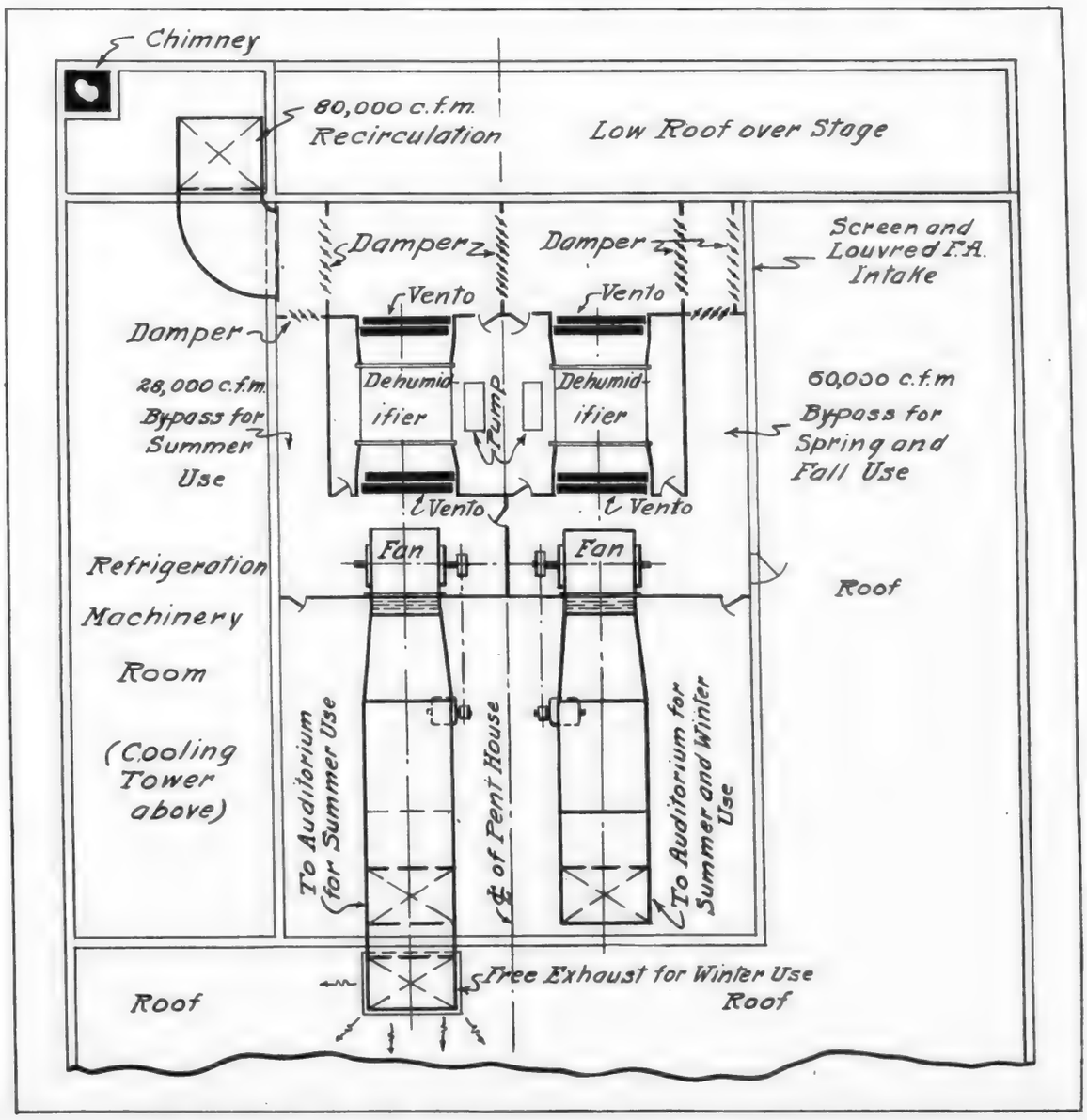

Fig. 5. Pent House Plan, Showing Arrangement of Apparatus for Picture Theater

ARRANGING THE VENTO IN ROWS AND E. D. R. OF EACH

Referring again to the temperature tables for Vento heaters, it can be found that the actual temperature rise produced by the first two rows, with the air entering at zero, is from zero to 43° F. The temperature rise for a single row is not indicated as this would not be sufficient to bring the air above 32° F. Consequently, one row should not be used alone; nevertheless, when it comes to the matter of pipe sizing, the amount of work done in the first section should closely be approximated in order to size the supply and return lines on a consistent basis.

As the first two rows give a temperature rise which is amply above 32° F. (freezing) these must be placed before the heater and the air heated to 43° F. before entering the air washer. This leaves the final two rows to go after the air washer and between the air washer and the fan.

Sometimes the two rows following the air washer are split into a single row placed between the air washer and the fan and the last row is placed in the discharge of the fan, while, in other cases, the two rows may be placed in the discharge of the fan with no heating surface between the air washer and the fan. This latter arrangement is not regarded as being as good as either of the other two schemes, probably owing to the fact that it requires the fan to handle saturated and very damp air, which may be avoided by placing at least some heating surface between the air washer and fan.

The matter of checking to see how much humidifying will be obtained with the arrangement of heaters decided upon should now be done. In the case under consideration, if the air leaves the air washer at 43° F. and saturated, being later raised to 70° F. in the reheater, the relative humidity at 70° F. will be

(24) Grains per cu. ft. at 43° F. and sat. .. 3.2
Grains per cu. ft. at 70° F. and sat. .. 7.98
3.2/7.98 equals .... 40% relative humidity.

Allowing that some moisture will be added through respiration in the theatre, this is not bad for zero weather. Of course, the moisture content can also be raised somewhat, if desired, by using heated water in the air washer.

The work done in the first row of Vento should carefully be calculated and the pipe sizes made ample, as this row, as well as the second, is subjected to temperatures below freezing; the chief difference is that the first row is subjected to temperatures down to zero and, in case of an extreme cold snap, the entering temperature, for a short time, may even be below zero. It is an easy matter to lay out a small temperature curve, such as is shown in Fig. 6, with the temperature on the left and the various heater rows along the bottom. This will show the approximate temperature rise secured in the first row, which is about 24° F. If 24° F. rise is secured in the first row and 43° F. in the first two rows, it is plain that the second row raises the temperature.

(25) 43° — 24°, or 19°.

Then the work done in the first row in B.T.U. will be the quantity of air per hour multiplied by the temperature rise and divided by 50, since 1 B.T.U. will raise approximately 50 cu. ft. of air 1° F.* The equivalent number of square feet of direct radiation can be obtained by dividing this B.T.U. by 240, the number of B.T.U. for 1 sq. ft. of ordinary radiation. Thus:

$$(26)\quad \frac{60{,}000 \times 60 \times 24}{50 \times 240} = 7200 \text{ sq. ft.}$$

Similarly for the second row the figures would be

$$(27)\quad \frac{60{,}000 \times 60 \times 19}{50 \times 240} = 5700 \text{ sq. ft.}$$

and for the third row

$$(28)\quad \frac{60{,}000 \times 60 \times 18}{50 \times 240} = 5400 \text{ sq. ft.}$$

while for the last row the E. D. R. would be

$$(29)\quad \frac{60{,}000 \times 60 \times 16}{50 \times 240} = 4800 \text{ sq. ft.}$$

With the "equivalent direct radiation" load for each row it is a simple matter to size up the supply and return pipe for each row.

Owing to the fact that there are such a large number of sections in the rows it will be advisable to feed each row from both sides and to take a return connection out of each end. With piping arranged in this manner, each branch connection to the heater can be considered as carrying half the load on that particular row but, in this case, some additional complications are caused by the introduction of two sizes of heater sections.

With the bottom tier 60 in. high and the top tier 50 in. high, the proportion of the row load will be

$$(30)\quad \frac{60}{60 \text{ plus } 50} = \frac{6}{11} \text{ for the bottom stack and}$$

$$(31)\quad \frac{50}{60 \text{ plus } 50} = \frac{5}{11} \text{ for the top stack.}$$

This proportion will hold for all the rows and, taking the first row, for example, the total equivalent direct radiation, which was ascertained to be 7200 sq. ft. (26), the 60-in. tier will be carrying

$$(32)\quad \frac{6}{11} \text{ of 7200 sq. ft., or 3927 sq. ft.}$$

while the 50-in. tier is carrying

$$(33)\quad \frac{5}{11} \text{ of 7200 sq. ft., or 3273 sq. ft.}$$

so that in feeding the 60-in. stack from both sides each branch connection with the stack would carry
(34) 1/2 of 3927 sq. ft., or 1964 sq. ft.
while in feeding both sides of the 50-in. stack each branch connecting to the stack would carry
(35) 1/2 of 3273 sq. ft., or 1637 sq. ft.

*In working in temperatures around 70° F., 55 cu. ft. of air will be raised 1° by 1 B.T.U., but at 120° F. only 50 cu. ft. will be raised 1° owing to greater density.

The other rows would be determined in the same manner, simply substituting the proper load for each respective row.

AUTOMATIC CONTROL FOR HEATERS

It is general practice to place automatic control on all rows of heaters except the first, which is exposed to the most extreme temperatures. The idea is to leave the first row "on" during all cold weather

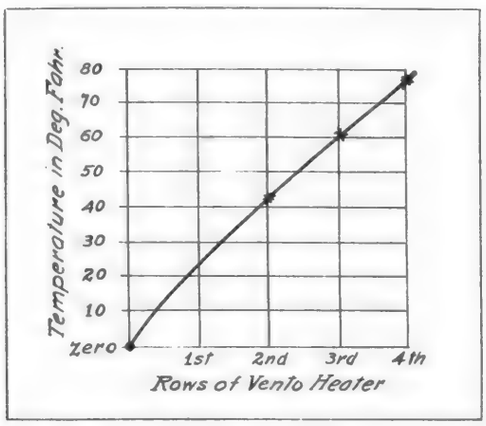

Fig. 6. Curve of Vento Heater Temperatures

so as to protect the following rows from the dangers of freezing. Therefore, in this case, it will be considered that the first row of heater is arranged for hand control and that it will be kept on during all freezing weather. The second row will be equipped with a diaphragm valve and will be operated by a thermostat located between the heater and the air washer so that any time when the air, after passing through the preheater (first section), falls below 43° F., the second row will be thrown into commission. The third and fourth rows would be controlled by thermostats located in the fan discharge or in the auditorium so as to throw both rows "on" whenever the temperature is below 65° F. and one row up to 70° F. with both rows cut out above 70° F.

LIGHT-WEIGHT EXTENDED-SURFACE HEATERS

With the use of heaters of the Aerofin type, slightly different methods will have to be pursued. These heaters produce a higher temperature rise per row and, therefore, there will not be as many rows required as with cast-iron heaters. Also, heaters of the Aerofin type have the velocities quoted for the heater face, instead of the free areas, as is the case with cast-iron surfaces. For this reason the velocity of 700 f.p.m. through the heater will be taken and this is nearly equivalent to the velocity of 1600 f.p.m. used for the free area of the Vento. The velocity has been reduced a little, owing to the greater concentration of the Aerofin and with the idea of having the size of the heater correspond as closely as possible to the size of opening into the air washer.

With 60,000 c.f.m. to handle and a face velocity of 700 f.p.m., the area of the Aerofin heater will be

(36) 60,000/700, or 85½ sq. ft.

Catalog data show that a heater with 9-ft. tubes and 5 sections high will have a net face area of 90 sq. ft. The width of this heater is 9 ft. 5½ in. and the height is 11 ft. 10 in., both of which work in well with the air washer dimensions.

Turning to the tables of temperature rises it is found that a heater, at a velocity of 700 f.p.m., will give temperature rises of the air as follows:

First row of tubes.....zero to 30° F.
Second row of tubes..... 30° to 57° F.
Third row of tubes..... 57° to 79° F.

From this it is plain that the preheater must consist of two rows of tubes with a temperature rise of from zero to 57°, while the reheater will consist of only one row of tubes with a temperature rise of from 57° to 79°. The sizing of the piping for these sections will follow along lines similar to those already explained for Vento heaters.

CEILING REGISTERS

This theater is approximately 180 ft. long and is divided by the roof trusses and their supporting columns into nine bays of about 19-ft. width. One bay practically is given over to the stage, and about half of the front bay is occupied by the projection room. This leaves 7½ bays in which registers may be placed in the ceiling, unless registers are placed in the ceiling under the projection room.

As the seats are arranged so as to cover practically the entire main floor, the entering air should be distributed so as to enter in practically equal amount all over the main ceiling. Putting inlets under the projection room will give eight full bays in which ceiling registers may be located and, with 120,000 c.f.m. of air* to feed into the auditorium. this will amount to*

(37) 120,000/8, or 15,000 c.f.m. per bay.

For the rear bay, in which the projection room is located, velocities of 100 f.p.m. should be used for the registers under the projection room, 150 f.p.m. for the registers on each side of the projection room, 200 f.p.m. for the registers in the main ceiling for the next two bays toward the front, 300 f.p.m. for the next two bays, and 400 f.p.m. for the balance where there is a very good height through which the air can fall before striking the occupants.

Based on these velocities the register area for the rear bay would be divided into about two-fifths of the air to enter under the projection room and about three-fifths from the high ceiling beyond the ends of the projection room.

(38) 2/5 of 15,000 is 6000 c.f.m.
3/5 of 15,000 is 9000 c.f.m.

With a velocity of 100 f.p.m. for the registers under the projection room, the net free area required is

(*Continued on Page* 75)

*The largest possible amount of air is taken in here to be sure to get ample register area.

Short-Circuiting in Heating Systems

How the Path of Least Resistance Affects the Piping Design and Why the Reversed Return Is Often the Answer

By Charles F. Wolfsfeld

Part I

THE "path of least resistance" is the inevitable course taken by all things animate and inanimate. To this rule steam, water and air are no exceptions. To expect moving steam, or any other medium, to follow the hardest course when there is an "easy way out" is little less than absurd. And yet designers of heating systems plan mains every day, the correct circulation in which would make it necessary for steam or water to follow a course of greater resistance. This, of course, it will not do. Even lightning finds time to take the line of least resistance.

Before proceeding with the subject of correct design, it will be of interest to consider the elementary laws concerning the behavior of fluids confined in closed pipes.

If we consider a short horizontal length of pipe, with up-turned open elbows at each end, as in Fig. 1 (the section being filled with water exactly to the top of the horizontal pipe), we would say, ordinarily, that this main is under no pressure. This would seem to be the case because the main has no vertical head, and its ends are open to the atmosphere.

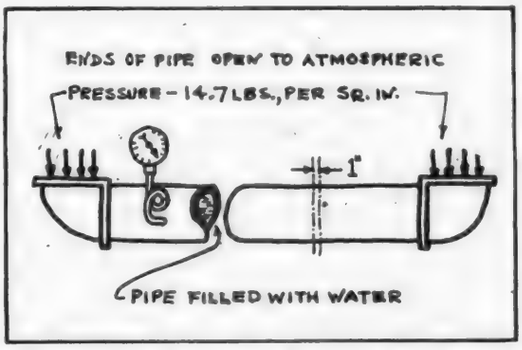

Fig. 1. Set-Up to Show That Pressure Within Open Pipe is That Due to Weight of Water Plus 14.7 Lbs.

If we could cut out a section of this main, with its contained water, and analyze conditions, it develops that this first-glance impression is not strictly correct.

CONDITIONS IN WATER-FILLED PIPE OPEN AT BOTH ENDS

To fix our ideas, consider this main of 10 in. internal diameter and filled with water at 63° F. (weight 62.4 lbs. per cubic foot). The weight of water contained in this main for a length of 1 in. would be

$$W = [\pi \times (10)^2 \div 4] \times 62.4 \div 1728 = 2.83 \text{ lbs.}$$

This weight of water is imposing a pressure upon the inner surface of the pipe, varying from zero, at the top of the pipe, to the maximum, at the bottom. (Fig. 2.) The pressure is due to the weight exerted by the water, and at any point is equal to the weight of water above that point.

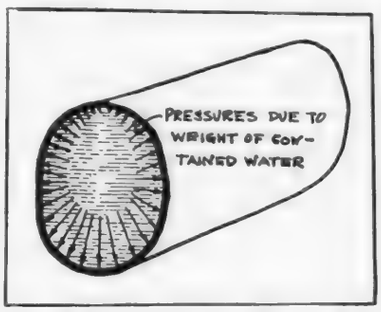

Fig. 2. Section of Pipe Shown in Fig. 1, Illustrating Varying Pressures at Different Parts of the Circumference

As shown in Fig. 1, the pressure of the atmosphere (14.7 lbs. per square inch) is being exerted at both open ends. This condition is commonly called the "zero pressure condition," corresponding to the zero calibration on pressure gauges. While the ordinary gauges seem to be convenient for practical purposes, they are confusing in an exact analysis. The pressure on the inside of the 10-in. water main is not merely that due to the weight of water, but to that pressure, *plus 14.7 lbs.*

It is true that the atmospheric pressure on the outside of the pipe neutralizes the tendency of this pressure on the inside to rupture the side walls and, therefore, that the tensile stress in the metal of the pipe is due only to the pressure due to gravity, but this is a matter of pipe strength and has no bearing on the behavior of the fluids within a closed space, as in the case of a vacuum heating system or a closed-tank water heating system where the outside atmosphere is entirely shut out.

RATE OF FLOW THROUGH BRANCHES HAVING DIFFERENT PRESSURES

If steam in pipe "A" (Fig. 3) is at 50 lbs. pressure per square inch and in pipes B and C at 45 lbs. and 20 lbs. pressure, respectively, one would

not expect a very great flow through pipe B, when compared with that through pipe C.

Like the laws governing the flow of heat, water and electricity, the element that establishes the rate of flow is the difference in pressure or head, be it thermal, hydraulic or electromotive.

In Fig. 3, the pressure difference between steam in pipes A and B is 50 — 45, or 5 lbs. per square inch, whereas the pressure difference between steam in pipes A and C is 50 — 20, or 30 lbs. per square inch. The flow, therefore, depends on these pressure differences, 5 and 30. This does not mean

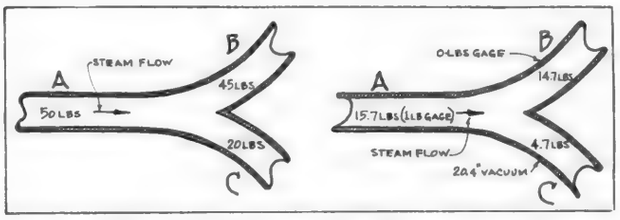

Fig. 3. (left) Under Conditions Shown More Steam Will Flow Through Branch C Than Through Branch B. Fig. 4. (right) A Condition Similar to Fig. 3 Except That One Branch Carries a Vacuum. The Flow Always Tends to Favor Greater Differences in Actual Pressures.

that the flow through C will be 30 ÷ 5, or six times that through B. It has been established that the flow through pipes varies approximately as the square root of the pressure-head; therefore, the flow through C will be $\sqrt{6}$ or 2½ times the flow through B, which, even at that, very decidedly favors pipe C and puts pipe B at a corresponding disadvantage.

Taking conditions such as may obtain in a vacuum heating system, the pressure difference between pipes A and B (Fig. 4) may be 15.7 — 14.7, or 1 lb. per square inch, and the pressure difference between pipes A and C may be 15.7 — 4.7, or 11 lbs. per square inch. In this case the flow through pipe C would be $\sqrt{11}$, or 3 1/3 times the flow through pipe B.

MISCONCEPTIONS REGARDING EFFECT OF VACUUM IN CAUSING STEAM FLOW

In studying the flow of steam in low-pressure heating systems it is well to disregard entirely the concepts, or rather misconcepts, of "vacuum" and "suction." The German expression "Lehr-raum," signifying "vacant space," seems less misleading than the English nomenclature.

When we inhale or "draw" air through the mouth we consider this an operation of "suction," and this term connotes the idea of pulling or drawing air from the atmosphere and conveying it into our lungs. Inasmuch as this is just the reverse of what actually takes place, the usual interpretation of the familiar terms is false and misleading. The action of our lungs during inhalation is very much like that of a bellows. The muscles, in distending the lungs, create a larger space within the lung walls, giving the entrained air an opportunity to expand. Due to the unceasing molecular motion of the air, it expands and fills the enlarged chamber. However, according to Boyle's Law, the pressure exerted by a gas varies inversely as the volume, for constant temperatures, which means that the air in our lungs, when expanded, loses much of its pressure.

This gives a condition very similar to those of Figs. 3 and 4, namely, a difference in pressures between that of the air in the mouth or nose (atmospheric) and that in the expanded lungs (below atmospheric), the result being a flow of air from the high-pressure to the low-pressure region.

When we inhale, therefore, the air is not being *"sucked"* or *"drawn"* in but *"forced"* in by the *atmospheric pressure.* Creating a vacuum accordingly is merely a process of reducing the density of a gas in a given volume so that gas at a higher density will expand as a fluid at reduced pressure, and fill it.

For use in studying pressure conditions in heating systems, a gauge, such as that shown in Fig. 5, would be helpful. The outer scale reads actual pressure, whereas the inner scale gives pressures above and below atmospheric pressure.

PRESSURES IN A TYPICAL TWO-PIPE STEAM SYSTEM

In Fig. 6 is shown a typical two-pipe steam heating system. If the mains and radiators of this system were insulated against all loss of heat, no steam would be condensed. For such a condition there would be no flow through the mains. The 1-lb. gauge pressure condition (15.7 lbs. actual) in this case would obtain throughout the entire system from the boiler to the farthest radiation; in other

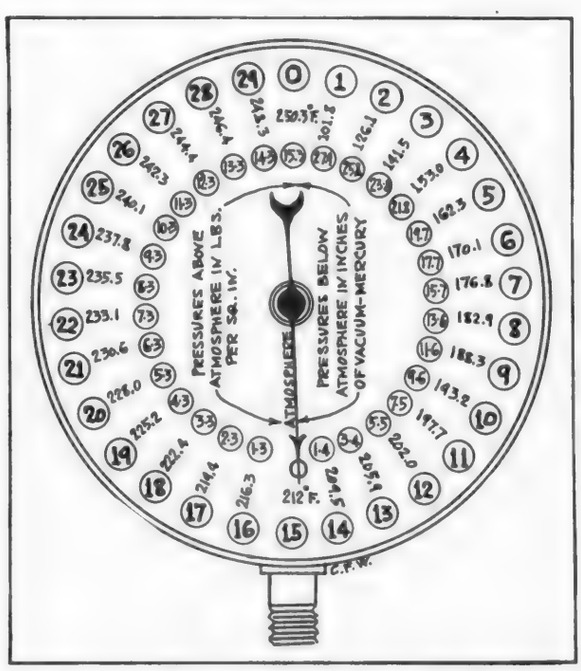

Fig. 5. Suggested Dial for Gauge for Studying Pressure Conditions Within Steam Heating Mains

The outer scale reads actual total pressures and the inner scale pressures above and below atmosphere. The temperatures indicated between these two scales are the corresponding boiling points.

words, there would be no pressure "loss" or "drop" anywhere in the line.

As soon as any portion of the system becomes exposed to air at a lower temperature than that prevailing within the system, the contained steam becomes cooled and condenses into water, occupying 1/1700 of its volume. The vacant space (vacuum) left by reason of this great contraction in volume momentarily causes a region of low pressure, which instantaneously is neutralized by a flow of steam from the generating unit—the boiler. The greater the amount of cooling, therefore, that occurs in any system, the greater will be the flow of steam, and for any given size of pipe, the greater will be the velocity of flow.

When steam or any other fluid is caused to flow through a pipe, a certain amount of energy is required to overcome surface friction. Steam does not "rub" against the inner surface of the pipe in the sense that two solid objects rub against one another, the action being like that shown in Fig. 7.

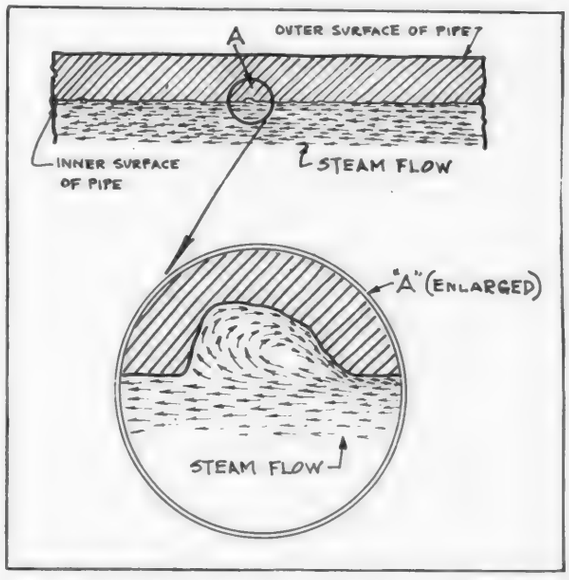

Fig. 7. Roughness of the Inner Surface of Pipe Sets Up Minute Disturbances Which Increase Resistance to Flow and Reduce Available Pressure Within the System

EFFECT OF SURFACE IRREGULARITIES ON INSIDE OF PIPE

In Fig. 7 is shown a magnified section of the interior surface of a pipe. The enlarged view of "A" —one of the surface irregularities—illustrates how the impinging particles of steam are caused to change and ultimately reverse their direction of flow, forming an eddy at this point. The steam that flows back against the main flow has the effect of producing a counter-pressure, causing a reduction in the main pressure, depending upon the severity and number of irregularities in a given length of pipe; or, to put it in heating and ventilating diction, the pressure-drop or resistance loss depends upon the roughness of the inner surface, and the length of run.

In new pipe the roughness may be due to method of manufacture; in old unused pipe, to rust, as well as method of manufacture, and in used pipe, to all of the above causes and, in addition, to the deposits of chemical salts or scale, depending for their character and magnitude upon the length of use of the pipe and the chemical composition of the boiler water.

A very important factor in connection with the roughness of the interior surface of a pipe line also is the manner of installation. In cases where a wheel-type of pipe cutter is employed, the pressure of the wheels tends to bend the pipe walls inward after the cutting action has reduced the thickness of metal to such a degree that its strength becomes insufficient for resisting the cutting pressure. This results in a small burr or shoulder on the inside of the pipe, which, like other irregularities, offers resistance to the flow of fluids moving within the pipe. In pipe of small diameter (¾ in. and smaller) this burr introduces such a high resistance that it should, in all cases, be removed by reaming.

RESISTANCES DUE TO PIPE FITTINGS

Then there are the resistances offered by pipe fittings at the joints. Where the ends of pipe lengths screw into the opposite ends of a coupling, tee, valve or other fittings, an appreciable distance usually is maintained between the ends of the pipe within the fitting. Steam flowing through this space expands to fill the enlarged chamber and strikes the shoulder created by the pipe end, reacting also in the manner of an irregularity.

It is common practice to apply white lead, litharge and glycerine, oakum, wicking and oil, asphaltum or other caulking materials to the threads of pipe before making up the joint, in order to insure tightness. Unless extreme caution is exercised, excessive caulking material or "dope," as it is known in the trade, will form an obstruc-

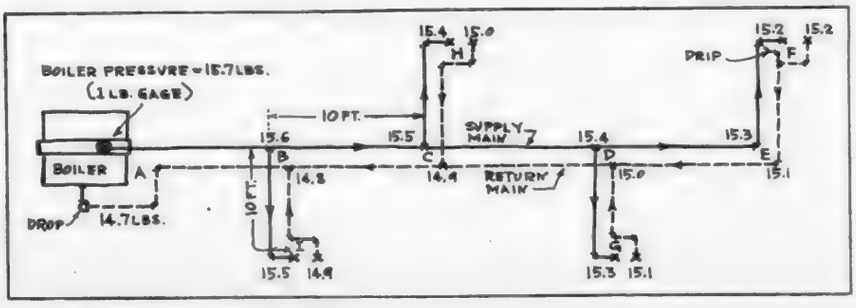

Fig. 6. A Simple Two-Pipe Gravity Steam Heating System

The differences in pressure between supply and return are greatest near the boiler and zero at the end of the main. The direction of flow in the supply is opposite to that in the return.

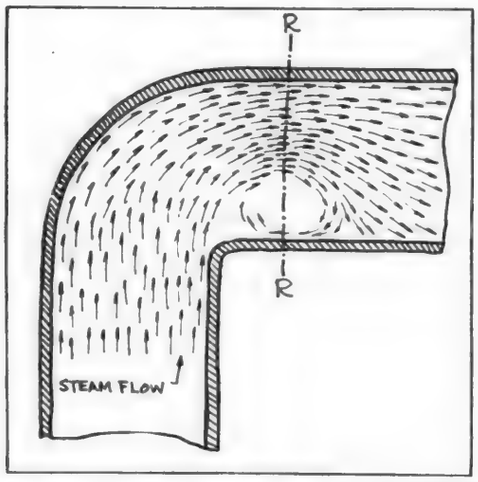

Fig. 8. An Abrupt Change in Direction of a Pipe Produces Eddy Currents Reducing the Effective Area of Cross Section R-R

tion that may prove an excessive restriction at the respective fittings. Still another element in the resistance to flow is change in direction.

RESISTANCE DUE TO DEFLECTION OF FLOW

When the path of steam or other fluids is deflected by means of Y, L, or tee fittings, or by means of short-radius bends in pipe lines, a considerable resistance is offered by reason of this deflection.

As shown in Fig. 8, the flowing particles as they pass the deflecting surface strike back at other particles, thereby tending to arrest their progress or, in other words, "cutting in resistance."

HOW VALVES, COCKS AND CHECKS ADD TO THE RESISTANCE

To the list of possible resistance-provoking features may be added restrictions caused by valves, cocks, checks and the like. As shown in Fig. 6, the boiler pressure is 15.7 lbs. (1 lb. gauge) and for the condition of maximum load, the pressure at the end of the line is 15.2 (½ lb. gauge). That is, the resistance offered by the main to the flow of steam in traveling from the boiler to the last radiator is of such magnitude as to reduce the steam pressure by 0.5 lbs.

To facilitate computations, the resistance or pressure-drop, due to fittings, valves, bends, etc., occurring in any particular run of piping very often is given in terms of equivalent resistance offered by straight pipe. If it is found that a 90-degree elbow in a 4-in. steam main offers the same resistance as a straight piece of 4-in. pipe 25 ft. long, the main would be treated as though it were entirely straight and increased in actual net length by 25 feet.

PRESSURE DIFFERENCES IN A TYPICAL TWO-PIPE GRAVITY STEAM SYSTEM

In the mains shown in Fig. 6, accordingly, the lengths assumed for the various sections represent the actual length of each section, plus the length equivalent to the resistances of fittings, bends, etc. As in the case of the steam-flow main, the pressure at the beginning of the dry-return main (end of steam main) suffers a half-pound loss due to resistance, maintaining a pressure in the drop connection to the boiler of (15.2 — 0.5) or 14.7 lbs. (0 lbs. gauge).

And right here is an interesting little portion of the system—a pressure of 14.7 lbs. in the return pipe connecting into the boiler with 15.7 lbs. in the boiler! These conditions are shown in Fig. 9.

If we imagine a closed valve in the return drop-connection to the boiler, located at the water-line, the pressure conditions could exist as assumed in the sketch. If, under these conditions, this valve were suddenly opened, what action should we expect? A flow from the higher-pressure region to the lower-pressure region, of course. It is merely another case of pipes A and B of Fig. 4. This flow would continue until the upward force of 1 lb. would be neutralized by the weight of the water it is lifting. The rise of water in this leg, therefore, would be 2 1/3 feet above the boiler water-line. In deciding upon an allowable total pressure-drop for an installation of this type, it is of utmost importance to consider the rising of the return water in connection with the available headroom. A pressure-drop of 3 lbs. would raise the return water 3 ft. x 2 1/3 ft., or 7 ft., a prohibitive condition for the average 10-ft.-high boiler room, because of danger of the return water backing up into the main.

Referring again to Fig. 6, it will be noted that the length of main between radiator branch-connections is 10 ft., including resistance, also that the length of each radiator branch from the main to the radiator tapping is 10 ft., including resistance. This gives a total equivalent run from the boiler to the farthest radiator of 50 ft. A ½-lb. drop having been assumed for this run, the pressure-drop between branches, as well as for the branches themselves, would be:

Pressure-drop per 10 ft. $= (10 \div 50) \times 0.5 =$ 0.1 lb.

The pressure in the steam supply connection to the farthest radiator consequently would be 15.2

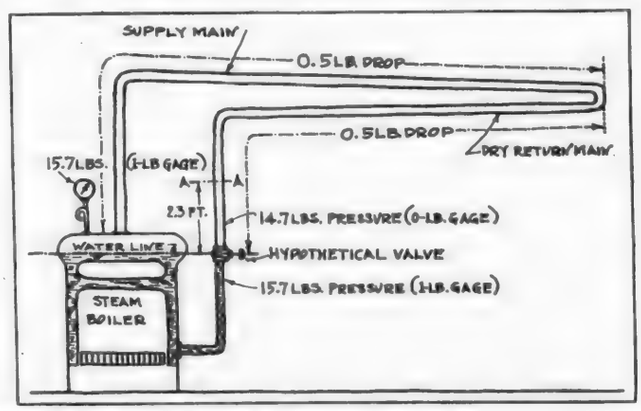

Fig. 9. With a Valve in Return Line at Boiler Water-Level, a Total Pressure Drop of 1 Lb. Would Produce Conditions Shown

With valve open, the water-level in return line would rise to point A-A, 2.3 ft. above boiler water line.

lbs., and that at the main where the radiator branch is taken out, 15.3 lbs. There being 1/10-lb. drop between all branch connections to the steam and return mains, and between each such connection and the radiator it serves, it is a simple matter to compute the actual pressure existing at each point of interest.

It will be noted that the steam pressure at the radiator nearest the boiler is 15.5 lbs., while that in the return connection is 14.9 lbs. The force tending to move steam, water or air through this radiator is the difference between these two pressures, namely 15.5 — 14.9, or 0.6 lbs.

The force tending to move steam, water or air through the radiator farthest from the boiler is 15.2 — 15.2, or 0 lbs. By applying this test to the other radiators, it will be observed that the circulation force increases as we come to the radiators near the boiler.

DIFFERENT REMEDIES FOR "DEAD ENDS" IN STEAM SYSTEMS

This "dead-end" condition at the last connection from the main, as well as the varying degrees of circulation, has been accepted by engineers and fitters as a necessary evil. In attempting to correct this fault they have sought to locate the boilers on the cold end of the boiler room, so as to favor the likely underheated portion of the building. At other times they would run a special steam connection from the boiler header to the "dead" portion of the main. And after having charged the defective operation to every conceivable item, from the size of coal to the type of air in the radiator, they would install larger radiators in the chilly spaces. If that doesn't help, what then?

The next installment will discuss pressures at various points on the return line, circulation in the last radiator, use of traps to maintain pressure differential, and the action of fluids when temperature and pressure increase, bringing out the importance of reversed returns to obviate short circuits in the steam lines.

Design of Heating, Ventilating and Cooling Equipment for Two Types of Theaters

(*Continued from Page 70*)

(39) 6000/100, or 60 sq. ft.
and for the registers at the ends of the projection room
(40) 9000/150, or 60 sq. ft. also.
For the next two bays in front of the projection room the free area would be
(41) 15,000/200, or 75 sq. ft.
while the two bays in front of these would require
(42) 15,000/300, or 50 sq. ft.
and the balance of the bays would have
(43) 15,000/400, or 38 sq. ft.

The exact way this amount of free area is to be obtained will depend somewhat on the design of the ceiling, but the areas should be approximated as nearly as possible to the theoretical ideal and as much distribution should be secured as the conditions will permit. In other words, there should not be large dead areas in the ceiling without registers, or good distribution and equal temperatures will not be secured on the main floor level.

FLOOR OUTLETS

To remove the air from the floor of the theater some sort of floor outlet must be employed. If a floor outlet approximately 6 in. in diameter is used, each outlet may be depended upon to carry off about 60 c.f.m., as a 6-in. circle has an area of about 1/6 sq. ft. and, at 400 f.p.m. velocity, the amount of air handled per outlet is
(44) 1/6 of 400, or 66 c.f.m.
so that 60 c.f.m. is conservative and, as no exhaust register can produce a draft, the velocity of 400 f.p.m. is quite allowable.

Assuming that floor outlets are spaced under every alternate seat, with 2700 seats there will be about 1,350 floor outlets, which will remove
(45) 1350 $\times$ 60, or 81,000 c.f.m.
and, with a total of three-quarters of the incoming air to be exhausted, the total exhaust, or recirculation, will be
(46) 120,000 $\times$ 3/4, or 90,000 c.f.m.
If the floor outlets handle 81,000 c.f.m. there will be a surplus of
(47) 90,000 — 81,000, or 9000 c.f.m.
which will have to be taken care of by step registers in the boxes. At a velocity of 400 f.p.m., this will require a free area of
(48) 9000/400 or 23 sq. ft.

CARRYING THE EXHAUST TO THE ROOF

A plenum chamber is provided under the main floor into which all exhaust outlets are connected and the air from this plenum chamber must be carried to the roof for recirculation. The most feasible point at which to carry this air up to the pent house is adjacent to the stage. At a velocity of 1000 f.p.m. the flue there located must have an area of
(49) 90,000/1000, or 90 sq. ft.

OTHER EXHAUST SYSTEMS

The projection room and the toilets, smoking room and retiring room will need separate exhaust systems, but as these may be of standard design they do not require to be discussed in detail here.

The concluding portions of this article will take up the discussion of the vaudeville theater and the revisions that will be necessitated in the calculations by the additions of a balcony in the building already illustrated.

Winners in Moving-Picture Theater Competition

Designs Submitted Range From Conventional Fan and Heater Layouts to Those Utilizing Warm-Air Furnaces and Gas Heaters

S. Carrasco
Winner of
First Prize

Mr. Carrasco is a graduate of the Chile Polytechnic Institute, of Santiago, Chile. He came to the United States in 1924, to familiarize himself with American practice in heating and ventilation. Following a course of instruction at the City College of New York, he entered the employ of the Raisler Heating Company, New York, as draftsman and estimator. He intends to return to Chile where he will become a partner in the firm of A. Delano and Company, heating, ventilating and plumbing contractors of Santiago. Mr. Carrasco reports that Chile is thoroughly alive to the importance of modern heating and ventilating methods, and he predicts great advances in the next few years in that section of South America.

Vernon H. Walther
Winner of
Second Prize

Mr. Walther started his career as a draftsman for Mehring and Hanson Company, Chicago, heating contractors and engineers. During the World War he gained much experience in connection with the heating of the Government cantonments at the Great Lakes Naval Station and at the Paris Island Marine Station. Later he was connected with Lewis and Capron, of Chicago, and for a brief time was employed in the Chicago office of the B. F. Sturtevant Company. Since 1923, he has been in the employ of C. W. and George L. Rapp, architects, of Chicago and New York, this firm being one of the largest theater and public building architects in the country.

IN the competition just concluded for the best ventilating designs for a small moving-picture theater, it is remarkable that no two competitors offered designs incorporating the same ideas. In fact, the layouts ran rather to the other extreme in producing a variety of schemes which would indicate a decided divergence of opinion as to the best, and even the most practical, means for ventilating theaters of this type.

As was noted in the conditions of the contest, the first prize of $100 was to be awarded to the contestant submitting the best ventilating scheme, regardless of cost—either first or operating. The second prize of $50 was to go to the contestant who designed the most practical scheme for the least expenditure as regards both installation and operation, as well as convenience in manipulation and requiring the minimum amount of attention.

After analyzing carefully the various designs submitted, it was the unanimous opinion of the judges that the design submitted by S. Carrasco, of the Raisler Heating Co., 129 Amsterdam Ave., New York, easily was the best ventilating one submitted, regardless of cost. The judges also were unanimous in awarding the second prize for the most practical scheme to Vernon H. Walther, 6821 Osceola Ave., Edison Park, Chicago, Ill. One of the winning designs is here reproduced, and the other will appear next month.

It is encouraging to note that the solutions in general showed a more careful adherence to the instructions as laid down, than was the case in the previous competition, and it was highly gratifying that no solution had to be discarded on account of the violation of any of the provisions of the contest.

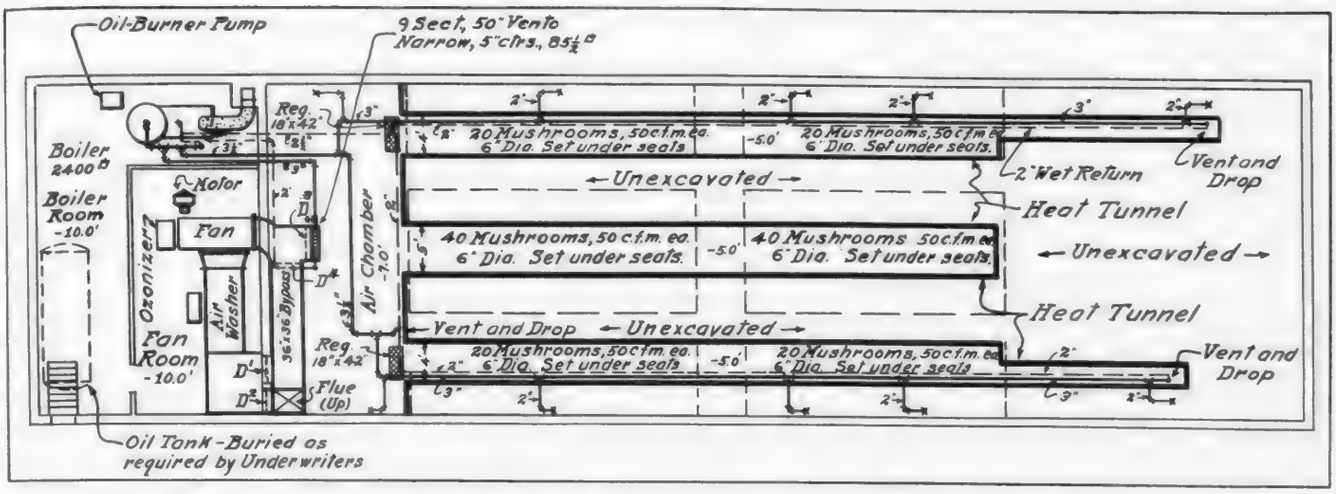

Fig. 1. Layout of Ventilating System for Moving-Picture Theater Proposed by S. Carrasco

The solution offered by Mr. Carrasco, winner of first prize, is shown in Fig. 1, which is his basement plan, and in Fig. 2, which is his first-floor plan. As will be seen by reference to Fig. 1, the return air is collected in three longitudinal air tunnels and passes back into the space marked "Air Chamber" whence it enters the plenum chamber in front of the air washer simply by opening the damper through the wall indicated by D-1 at this point. The air then is passed through the air washer where it is washed and cooled, after which it is purified by means of ozone, picked up by the fan and discharged through the 36-in. x 36-in. by-pass into the flue going to the ceiling outlets, as indicated in Fig. 2. In this case dampers D-1 and D-4 will be open and D-2 and D-3 closed.

Thus, for summer use, the design provides for downward ventilation, the air entering at the ceiling and passing out of the theater at the floor through a total of 160 mushrooms. No cooling is contemplated in the layout submitted beyond that obtained with the use of a 9-ft. air washer but Mr. Carrasco states that provision should be made for a cooling plant so that it may be installed later if desired.

In the winter the ventilation may be reversed and upward air flow used, the air entering the theater through the mushrooms in the floor and passing out of the ceiling outlets and back to the air washer through the vertical flue and damper. In this case the by-pass would be shut off, and the air discharged by the fan would pass through the Vento heater shown before entering the space under the floor of the theater. This theater is thermostatically controlled and, when operating in this manner, the dampers, D-1 and D-4 would be closed and the dampers D-2 and D-3 would be open.

This design contemplates supplying 25 c.f.m. per occupant and exhausting the same amount. The velocity of the air at the floor inlets is 250 f.p.m. and, at the ceiling registers, 350 f.p.m. The only point on which this design might be criticized

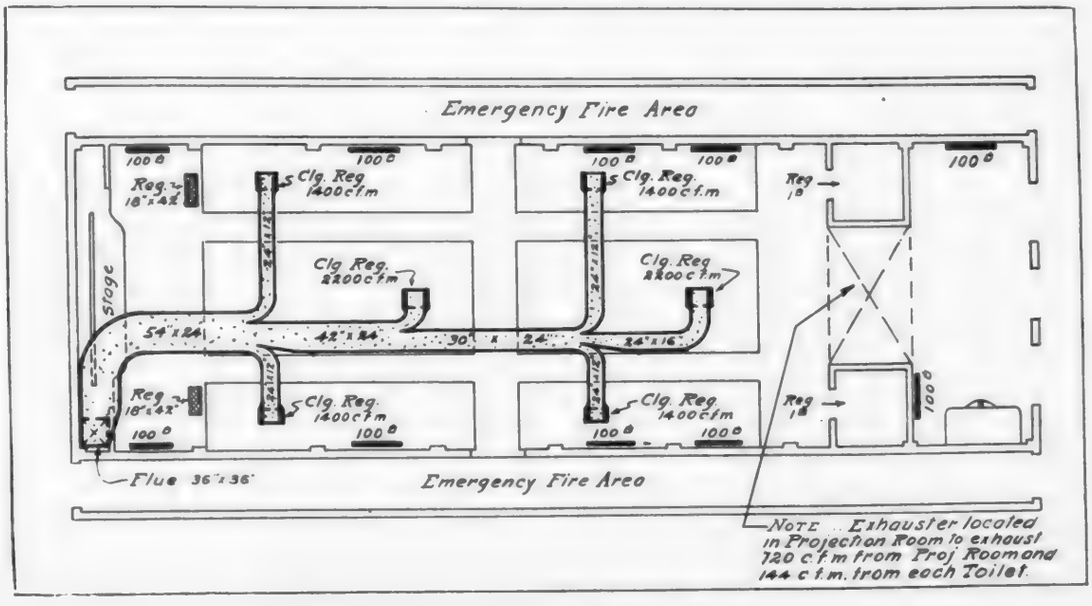

Fig. 2. First Floor Plan, Showing Ceiling Fresh Air Outlets

is on the recirculation of 100% of the air at all times which, it might be claimed, is not in accordance with the general practice of recirculating only 75% of the air when the theater is occupied and of adding 25% of fresh air during such periods. Of course, when the theater is not occupied there is no objection to rotating all the air without the addition of outside air. This design, however, lends itself to such an alteration very easily as all that would have to be done would be to cut an opening in the chamber just in front of the air washer so as to connect this chamber with the outside air and to insert therein a damper so that outside air up to 25% of the total volume could be used when desired.

In regard to the heating, this is taken care of entirely separate from the ventilating system and the building has been figured for a 70° F. inside temperature when the outside temperature is zero. Steam is supplied from an oil-fired, steel, steam-heating boiler and radiators are placed at various points and are of the sizes shown in Fig. 2. The steam and return mains are run in the air tunnels and are covered; a gravity one-pipe system is used to supply the radiators.

In describing his system Mr. Carrasco states:

"During the winter I propose to heat the air to 75° F. by means of a Vento unit. The air will be sent into the theater through mushrooms under the seats and two registers in front. I assume that this air will be around 68° F. when entering the theater.

"The air will be exhausted at the ceiling through the duct work in furred-down ceiling and taken down through the air washer, ozonizer and fan.

"In this way I have a system able to recirculate 100% of the air, which has all the advantages of clean, purified, properly heated and humidified air, besides all the economy in fuel saving.

"The system is reversible for the summer season. In that case the air will be taken from the theater through the mushrooms and registers and passed through door D-1 into the air washer for cooling. It will be purified or ozonized and sent by means of the fan and the by-pass duct to the duct work at the ceiling into the theater. In this case dampers D-2 and D-3 will be closed. Damper D-1 and damper D-4 open.

"Resuming: In winter, warm air will be admitted at the floor and exhausted for recirculation at the ceiling. In summer, cold air will be supplied at the ceiling and exhausted at the floor for recirculation.

"All mushrooms and registers must be provided with some way of regulating the amount of air.

"The Vento stack will be thermostatically controlled as well as four radiators in the theater.

"The projection booth will be separately ventilated, taking from this system two branches for the toilets. The supply for the toilets will be through a register at the bottom of the door.

"I recommend the installation of an air washer with two banks of sprays and 9 ft. long in order to have the maximum cooling possible without a refrigerating plant.

"Nevertheless, arrangements should be made so as to use the same air washer should it later be found necessary to install a refrigerating plant.

"I selected a low-speed fan in order to have noiseless operation. The fan will be cork-insulated and connected to the duct work by means of canvas.

"The heating system is one-pipe gravity.

"I propose to burn oil, thus enjoying the advantages of cleanliness, greater efficiency and control."

Draft and Its Part in Boiler Performance

By T. W. Reynolds

THE primary purpose of a chimney is to serve as a container in which to destroy equilibrium and thereby effect a difference in pressure, which, in turn, causes the gases within to flow. The volume of gases determines the area or capacity of the chimney, but has nothing to do with the draft. Natural draft, then, is the difference in pressure as produced by a chimney and a difference in temperature available for the flow of gases.

We commonly use such phrases as "sitting in a draft," "closing the draft in a furnace," and so forth—expressions which are erroneous in the face of facts. Draft is not velocity, nor is it a wind or current of air or gases. It is simply a static force; a difference in pressure or head between any point inside the chimney and the outside atmosphere. The actual motion or movement of wind, air, or gases, to the point of lower pressure is not draft, but rather the direct result of draft or difference in pressure.

We may sit at the window in a current of air, or we may shut off the air supply to a boiler and therefore throttle the circulation of air and gases, but we do not sit in a draft, nor do we close the boiler draft. As a matter of fact the draft is greatest when the air inlets are closed, due to the fact that there is then no circulation of gases and therefore no friction to use up or decrease the amount of draft.

The chimney may be considered by various analogies, for example, as a vertical heat-engine, whose function is to pump air into the fuel bed in order to assist in the production of gases, to pass these gases through the rest of the installation, and to expel them from its top. Again, the action of a chimney may be considered as analogous to the head produced by a tall standpipe full of water, except that the action is reversed.

Gases expand when heated due to the increased velocity of the molecules which forces them still farther apart. As a result the volume may be increased, thereby decreasing the weight per unit of volume. From this it will be seen that the difference in pressure, or the draft, as produced by a chimney, is due to the difference in weight between the warmer and therefore lighter gases in-

side the chimney and an equal column of cooler outside air; hence in approaching an equilibrium, which is never reached, the cooler air outside continually flows to and into the chimney at its base, thus making the direction of flow from the outside to the inside, at the base. On the other hand, the difference in pressure or head of a standpipe is due to the difference in weight between the water inside the standpipe and the outside air, but the direction of flow is from the inside to the outside at the base. In each case, gravity is the actuating force, producing draft in the first case and, in the second case, static head.

Desired rate of combustion is the controlling factor of chimney height, not the size of boiler plant. There may be the same rate of burning in a small as in a large boiler, so that the same height of chimney should be provided in one case as in the other, but the relative chimney areas will, of course, not be the same, because that factor is dependent on the quantity of gas to be carried off.

With gases of the same temperature entering the stack, the mean stack temperature will vary with the velocity of the gases, or in other words, with the amount of coal burned (assuming constant supply of air per pound of coal). Consequently, the greater the ratio of area to pounds of coal the slower will be the travel of the gases and the lower the mean temperature. This also goes to show that many formulae and tables now in use, in which the height* decreases as the area increases, without limit, are not practical in conditions which are usually found in house-heating installations with varying load. It therefore will be seen that if the area be increased, a point will be reached where, owing to decreased velocity, the gases will be cooled to such an extent that the draft required will necessitate increased rather than decreased height of stack.

Draft intensity, or pressure of draft required to overcome the resistance of fuel bed, boiler setting, and so forth, is what determines the height of the chimney, but the capacity requirements, or we might say the quantity of draft required due to the volume of gases generated, is what determines the effective area of the chimney, although the area and height each have a secondary or indirect influence upon the other, particularly the height** upon the diameter.

It is better to have a chimney too large than too small in diameter, for the velocity of the chimney gases may be increased by a fan, whereas if the diameter is too small, the situation is almost hopeless. Also it is better to have the chimney too high than too low, for if it is too high the draft can be controlled by a damper, whereas if the chimney is too short, it would be necessary to use a fan or add to the height of the chimney. So tall chimneys are not always monuments to the folly of their builders.

It is not a good policy to attempt to increase the capacity of an existing chimney by adding to its height, because as a general rule the increased capacity, due to the increased head, or velocity, is only a small part of the increased capacity required.

The draft of a chimney increases with the temperature of the gases, but the capacity of chimney increases with such temperature changes only up to about 600° F., after which the capacity actually decreases, because of the frictional losses set up by the increase in velocity as required by the expanded volume of gases. Therefore, there can be no direct relation between draft and capacity. As a matter of fact, the maximum draft of a chimney is obtained when the complete installation is practically air-tight and no air is admitted to the fire. In this case there would be no movement of gases, hence the actual capacity would be zero.

*Some well-known tables give heights for the same load that range from 20 ft. to 120 ft. According to such tables a 60-ft. chimney whose diameter or side is 12 in. may be reduced in height to 30 ft. if made 14 in. round or square. Again a 30-ft. chimney whose side is 24 in. may be decreased in diameter or side to 21 in. if the chimney is made 60 ft. high. At a load of 10,000 sq. ft. the diameter or side would be 30 in. at 70 ft. high, and 34 in. at 30 ft. high.

**Referring to that portion of the height necessary to overcome the loss of draft due to friction within the chimney.

American Fuel Resources

THE fuel resources of America can be referred to in a general way as not only abundant but as superabundant. No lack of fuel for warmth or industrial development has so impressed itself on our people as to form habits of high appreciation of fuel. On the contrary, our habits have reflected a general indifference to the significance of fuel in our modern life. While other peoples conduct great industries using fuel whose heating value, pound for pound, is less than half that of ours, we use the finest coals on earth indiscriminately for general purposes. For generations our fight was to rid the land of the forest, and we burned remorselessly. The passing of this phase of national thoughtlessness and wastefulness is to be expected. There are evidences of a new attitude of mind toward our fuel resources. Our forests are gone, cheap labor is no more, nations have fought for coal fields, and there is a growing appreciation of the part that fuel plays in furnishing the material blessings of our daily lives.

GROWING APPRECIATION OF THE VALUE OF FUEL

Our fuel assets have been expressed in such tremendous figures that their enumeration has made us tolerant of waste, although we have evidence that even big figures have an end. Natural gas has come and gone in many communities. Our finest coking-coal district is depleted. A limit to the availability of anthracite is more than hinted. All of these facts give new meaning to an enumeration of our fuel assets. Proud of their immensity, we nevertheless propose to develop habits of rational use rather than of prodigal waste.—*O. P. Hood, chief, Technologic Branch, U. S. Bureau of Mines, before the First National Fuels Meeting of the A. S. M. E.*

This is the twenty-eighth lesson of The Heating and Ventilating Magazine's

New Home-Study Course in Gravity Steam and Water Heating

Lesson No. 28—Boiler Connections*

By Ara Marcus Daniels

CONNECTIONS for steam and water heating-boilers require consideration from the viewpoints of (a) expansion of the piping, (b) number and size of outlets, (c) local conditions governing arrangement of piping.

There are required (a) steam or supply connections from the top, (b) water or return connections at the bottom, (c) top and bottom blow-off connections, (d) a drain line and (e) a cold-water filling line.

Fig. B-5-1 shows approved methods for making connections to a single boiler, while Fig. B-5-2 shows two boilers cross-connected, using check valves and so valved otherwise that either boiler may be used independently or both may be in service at the same time. Piping methods for cross-connecting boilers are many and varied. Equalizing pipes on both supply and return sides, as shown in Fig. B-5-2, are not always installed. Their use is advisable.

For steam work, angle or globe valves are used on the supply connections, and gate valves for the return lines for cross-connecting piping. For water boilers, gate valves should be used on both sides.

Contrary to the practice of many, boiler outlets and inlets should not be bushed but connected full size. The number and sizes of supply openings determine the outlet velocity, while the number and sizes of inlet openings have been established to assure uniform distribution of the return water over the boiler heating-surfaces.

Steam heating-boilers, unlike power boilers, are not provided with means for assuring dry steam entering the supply lines through the use of "dry pipes" or "separators." Hence, velocity of flow through the outlets of such boilers should be relatively low—not over 15 ft. per second, if the carrying over of water with the steam is to be avoided. Drip connections for the header, therefore, are an essential. These considerations should be borne in mind when boiler connections are being designed or installed.

*Copyright, 1927, Ara Marcus Daniels.

The filling connection for steam boilers on the better class of work should be fitted with two standard gate valves and with a swing check valve placed in a horizontal run of piping. The use of a check guards against the danger of an excessive boiler pressure backing up into the plumbing system.

In cross-connecting two steam boilers of unequal size or height, care must be observed to place them in such positions that the normal water-line level of one is the same as that of the other. A pit may

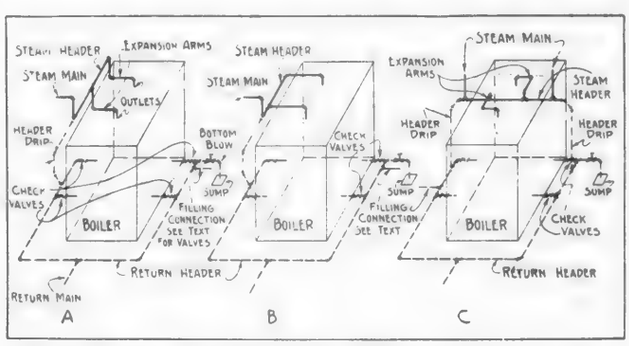

Fig. B-5-1. Typical Heating-Boiler Connections for Single Boiler

be required for the larger or a foundation for the smaller.

Fig. B-5-3 illustrates the Hartford loop as applied to one or a battery of boilers. This method of boiler connection originally was designed by the Hartford Insurance Company and it eliminates the use of check valves.

The size of the equalizing pipe depends upon the grate area according to the following table.

Table B-5-1.
Equalizing Pipe Sizes
for
Hartford Loop.

Grate Area Sq. ft.	Pipe Size In. Diam.
Under 4	1½
4 to 15	2½
Over 15	4

This equalizing pipe may be connected to the header, to the supply main, or to a supply tapping at the top of the boiler and to a return tapping at the bottom. The return mains should be connected into the equalizer pipe 2 in. below the boiler water-line.

This system, in addition to eliminating check valves from the return mains, assures a steadier water-line and prevents water being drawn from the boiler through formation of a partial vacuum, due to the cooling of the system.

CLEANING

Uncleaned boilers may be the cause of seemingly faulty heating systems. No installation job is complete or finished until the boiler has been thoroughly cleaned.

Boilers were used to generate steam for power long before their use for heating. Hence, the heating boiler is a form of the power boiler. Not always, in this adaptation, has proper consideration been given to the two distinct classes of service.

Sediment in power boilers causes sluggish circulation and retards heat transmission from fire to water with resulting reduction in power. Oil or grease in heating boilers causes priming and unsteady water-line, which, while these affect output, may be manifested somewhere else about the system and thus divert suspicion from the possible condition of the boiler.

In order to transmit heat throughout the piping and radiators of a steam heating-system uniformly, effectively and economically, the steam should be dry. Dry steam will circulate more rapidly and effectively than heavier wet steam. Wet steam flows slower, may be sluggish, tends to "fill" pipes with water at the turns, causes pressure-loss with resulting increased condensation, which, accumulating in drops from the mains, can interfere in the operation of air-relief equipment. With oil or grease on the water surface of a boiler, dry steam cannot be generated.

Power boilers were and are provided with a mud blow-off located near the bottom for clearing sediment and scale deposits. Heating boilers cannot be cleaned properly of oil and grease by bottom blowing. The job must be handled from the top as well. Plugs sometimes are provided on the side of the steam dome for surface blowing which, obviously, are to be used for cleaning purposes. Such, however, are not a part of all heating boilers, especially those of the small and moderate-sized residence type.

Oil, grease and grit from the piping and radiation of a heating system, slowly, are washed down into the boiler. The presence of such often may be apparent when the boiler is first put in service; or, it may require from one week to a month or longer for this foreign matter to find its way into the boiler. Where the piping system has drops fitted with plugs so as to permit blowing out grease and dirt that may have accumulated in the drops, this should be done before cleaning of the boiler is begun, and then repeated after the cleaning process.

The operations in cleaning a steam boiler as recommended by many boiler manufacturers are enumerated as follows:

First: Draw fire in boiler and drain water from the entire system.

Second: Close all radiator valves.

Third: Close valves on supply and return main (if such are installed).

Fourth: Remove damper regulator and plug opening.

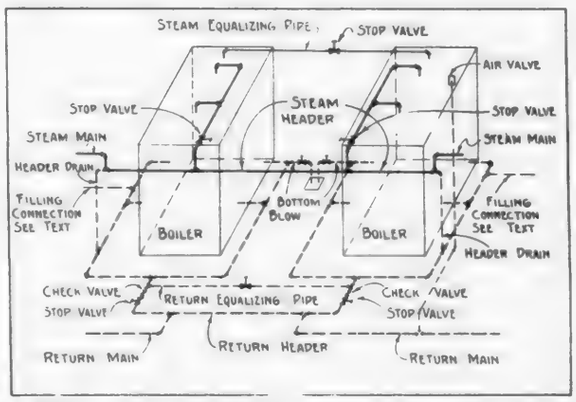

Fig. B-5-2. Typical Piping for Cross-Connecting Heating Boilers Using Check Valves and Equalizers in the Returns

Fifth: Remove the safety valve and connect a blow-off pipe to the opening and extend this pipe to a suitable drain outside the building. The size of this pipe should be not less than the size of the safety valve and should be provided with a full-size cock or gate valve.

Sixth: Fill boiler with water to the proper level and with valve closed in safety-valve line build and develop a hot fire creating a steam pressure between 5 and 10 lbs. per square inch. Do not exceed 12 lbs. pressure.

Seventh: With pressure of 5 to 10 lbs. on the boiler, open valve in safety-valve line and permit the passage of water, steam, oil and grease to pass to the drain. Continue this operation for at least 2 hrs. and possibly for 6 to 8 hrs., depending on the condition of the water driven off, maintaining continuously a pressure of about 10 lbs. per square inch. During this operation feed cold water into the boiler at the bottom so as to maintain the boiler water-line at the top of the gauge glass.

Eighth: During the last hour or two, depending on time devoted to boiling out process, fill the boiler full of water and allow the water to flow through and out the safety valve blow-off line.

Ninth: Close the water-feed valve and permit water and steam to flow through the safety-valve line until the water level in the boiler is at the top of the gauge glass. The steam gauge should indicate at least 10 lbs. pressure when this level is established.

Tenth: Close the gate valve in the safety-valve line and immediately open the bottom blow-off valve, drawing the fire enough to avoid building up excessive pressure.

Eleventh: Drain boiler completely, maintaining just sufficient fire to the end to assure a pressure for driving out the last gallon of water.

Twelfth: Pull remaining fire immediately, open all fire and flue doors so as to cool off the boiler; close bottom blow-off valve, remove safety-valve pipe line, replace safety valve and damper regulator (if installed) and fill boiler to normal water-line.

Thirteenth: Open main- and return-line valves and all valves on radiators, and build new fire.

Fourteenth: Steam the boiler to a pressure of about 5 lbs. and test for cleanliness:

(a) by opening gauge cock so as to emit steam or vapor and observe whether it is invisible as it jumps from cock and leaves a short gap between end of cock and steam; it should not condense readily or form bubbles on the inside of the glass.

(b) or by drawing a sample of water to a depth of 2 in. or 3 in. from the gauge cock into a vessel at least 3 in. in diameter and 8 to 12 in. deep, and boiling the sample over a hot fire and observing whether the boiling causes it to foam and overflow the vessel. If the water is clear and free from oil, grease, or impurities, no foaming will be evident, and bubbles from the boiling water will be seen plainly at the top.

CLEANING THE GAUGE GLASS

The gauge glass should be kept clean so that it will indicate clearly the true water level in the boiler. Oil and grease will dirty the glass and it may be advisable to clean it before waiting until the boiler is drained. The steam pressure on the boiler before commencing this cleaning should be at least 1 lb. The approved method of cleaning is as follows:

First: Draw about a pint of water from the pet cock at bottom of gauge and into this put a tablespoon full of hydrochloric acid.

Second: Close all gauge cocks.

Third: Open top gauge cock and pet cock at bottom and blow water out of the glass.

Fourth: Quickly close the top cock and submerge the bottom pet cock in the water-acid solution so that the vacuum action will fill the gauge glass with water-acid solution.

Fifth: With the bottom pet cock completely immersed, alternately open and close the top gauge cock so as to expel and refill the gauge glass with the water-acid solution until all grease, oil or other matter on the inside of the glass is removed.

Sixth: Close bottom pet cock and open both water-gauge cocks.

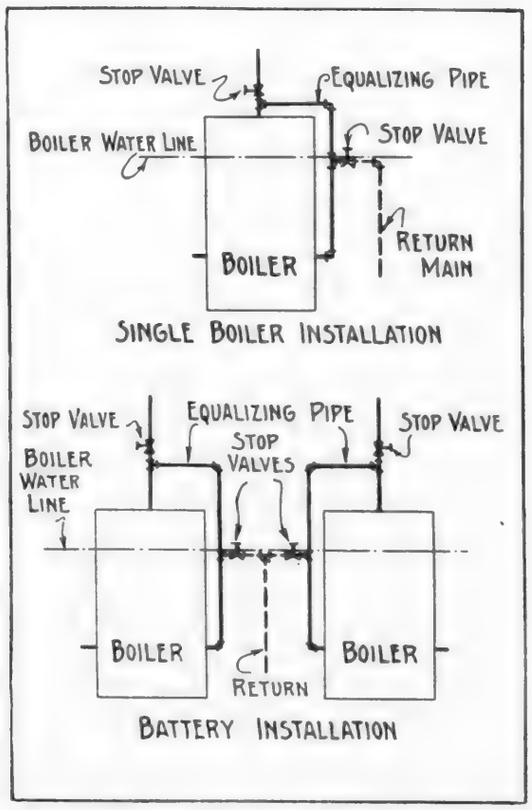

Fig. B-5-3. Application of the Hartford Return-Loop for Installations of Single Boilers and Batteries of Boilers

GENERAL CHARACTERISTICS OF BOILER SELECTION

The selection of a boiler seldom has consideration commensurate with the importance which rightly belongs to it. Unfortunately and too frequently, boiler selection is the result alone of reference to catalogs and requests for proposals. The heart of the heating system is considered by many to be any cast-iron or steel boiler fitted with a grate for coal burning, having an ash-pit and capable of holding water, with a figure opposite its designation in a catalog that is somewhat greater than the total standing direct radiation on the job with which it is to be used.

Water may be heated or boiled and steam may be generated with almost anything called a boiler. But to make steam with consumption of least fuel and least attention, careful, proper and thoughtful consideration should precede boiler selection. Without performance data, boiler selection is like groping in the dark. Without due consideration of the relation of operating demands to boiler efficiencies, boiler selection is little more than guesswork. A boiler that is too small must work near its highest per cent of maximum output, which may mean relatively low efficiency. If too large, it operates much of the time at such a low per cent of its output that its efficiency is also relatively low. In both cases, too much fuel is burned.

Performance tests of boilers usually will indicate somewhat higher efficiencies for steel than for cast-iron types, especially in the larger sizes. Steel boilers cost more than cast-iron boilers. A steel boiler generally is received as a complete unit requiring only that it be placed in its proper position. Cast-iron boilers are designed generally to permit their handling through standard sizes of doors or windows. Skill is required in assembling or "setting-up" cast-iron boilers. If a steel boiler is to be used, it is necessary to know that it can be taken into the building through existing open-

ings. All these and other considerations must be borne in mind when deciding between a cast-iron or steel boiler.

PROVISIONS FOR EXTENSION

Oftentimes, it becomes necessary to extend the heating system by the addition of radiating surface, or a more elaborate piping layout to care for an adjoining structure. Such possibility should be considered when originally designing the system and selecting the boiler. Cast-iron boilers (sectional or round) may have capacities increased to certain limits by the addition of sections. Increased capacity for a steel boiler usually means replacement by a boiler of larger capacity or by the installation of a second boiler.

CONSTRUCTION FEATURES

The construction features have much to do with successful boiler operation and are points that very properly should enter into selection. For instance, with shaker bars extending through large holes in the base, with ash-pit and fire doors loose fitting, control of the fire is almost impossible, so that the heating plant is a nuisance rather than a convenience. Where low basements demand boilers with low water-lines, it is essential to avoid a boiler in which combustion space and heating surface have been sacrificed to obtain a low water-line. All draft doors and check dampers should fit perfectly tight, work easily and thus afford proper means for controlling the combustion of the fuel.

FUELS

Selection as to type is important. The kind of boiler to select should be governed by the particular job in question with due regard to the conditions which will attend its use. Nothing is more important than that the boiler be suited to the fuel to be consumed therein. Boilers are designed for hard coal, soft coal, and liquid fuel. A hard-coal-burning boiler will not always burn soft coal satisfactorily, nor will a soft-coal-burning boiler always burn hard coal economically. Liquid fuel can be burned in a coal-burning boiler, but not with as high efficiency as will result from consumption in a boiler designed for oil burning. The problem is different. Combustion conditions differ and the boiler in which characteristics of combustion of the different fuels has had consideration during design, will give the best results.

ATTENDANCE

Some coal-fired boilers require more attendance than others. Generally speaking, the most satisfactory service with highest efficiency can be expected when the most attention is given boiler operation. Heating boilers are built primarily for long firing periods—that is, so that relatively little attention is required. On general principles, this is opposed to economy of fuel consumption. It is a problem that confronts and must be determined largely by the man who pays the fuel bill and operates the boiler—as to whether he will give it frequent and careful attention and thus economize on fuel and obtain better combustion, or whether the time consumed is more valuable than the fuel saved.

Dirty fires caused by neglect in shaking, failure to clean regularly, careless attention to the drafts and boiler surfaces improperly cleaned easily may result in a loss of 25% in efficiency of operation.

BREAKDOWNS

A breakdown always is a possibility. In the case of hospitals, schools and similar establishments, consideration to provide reserve units to guard against the possibility of the structure being without heat is advisable. Where such provision is made, it is customary to install two units, each of about two-thirds the required capacity, so that by operating one boiler, the unit will be proportioned more nearly to the average load requirements and if one boiler should fail temporarily, the remaining unit, by overloading, if necessary, could carry the load until repairs are made.

Where boilers are used for power and heating, or where heating demands are rather severe and continual, it is advisable to provide at least one reserve unit to permit the withdrawing of a unit from service for the purpose of cleaning.

ERECTION

Placing or erecting of the boiler also is a matter of importance. In the case of round or horizontal sectional-boilers, skill is required in connecting the sections, for unless the joints are true, there is danger of cracked sections; unless they are tightly cemented, air and gases may short-circuit between sections or excess air may enter at undesirable points. No leakage should occur around the base. When the draft door is closed, no air should be able to pass into the boiler; otherwise, control of the fire is impaired.

COVERING

The application of a good insulating covering, such as asbestos or magnesia, is essential. Reduction of heat emission from the boiler frequently may raise the efficiency appreciably. Although for certain reasons the piping may be left exposed, the boiler should be covered.

LOCATION

It is best to locate the boiler as near as possible to the chimney and to place it so that the smoke-pipe can be installed straight into the chimney, omitting elbows if practical. The student is referred to a preceding lesson covering chimneys and flues.

(*Continued on Page* 87)

PIPECRAFT

X—Vento Heater Connections for Gravity Steam Systems

IN connecting up Vento heaters a multitude of varying methods have been used, and it would be impossible in an article of this character to go into detail concerning every scheme which has been evolved; there are, however, some general features which have been found to give good service and if these are used as a basis the smaller modifications may be added at will. As an abstract principle it has been found desirable to run the steam header for any bank of Vento heaters considerably below the level of the steam inlet tapping on the sections, and to rise up to the steam inlets for the various rows from this header with branches of required size.

This is illustrated in Fig. 78, and reference to this drawing shows that expansion in the header is provided for by the spring in the smaller branches rising up to the steam inlets. The longer these branches are made, the greater the amount of movement they will absorb. At the end of the header sometimes is provided a drip, especially if the steam main enters the header on the level; this is not usually the case as it is more common to have a drop in the steam main where it runs down to connect with the horizontal header and then the bottom of the drop *must* be dripped with an additional drip at the end of the header, if desired.

The objection to running the steam header on the same level as the steam inlets into the heater, consists in not allowing sufficiently for the header expansion if the heater branch connections are made short and in throwing the header out a long distance from the heater if the heater branch connections are made longer. Where the horizontal header is run above the level of the steam inlets into the heater it is necessary to drop down to each steam inlet, and when the valves on the branches are closed this produces a pocket which fills up with water.

Larger Sizes of Heaters

When the number of sections in the single heater stack is sufficient to require feeding from both sides, it is desirable to modify the steam connections so as to get both steam branches to the same stack on a single valve, if possible. This may be accomplished by installing the header in the same manner as illustrated in Fig. 78, except to change the elbow, going into the steam inlet of the stack, into a tee and carrying the balance of the steam for the other side out of the top of this tee and over the top of the heater to the steam inlet connection on the other side.

Where the stacks are set two rows wide, the steam connections should be placed on the outside of each stack, with the two return connections in between the stacks, as the return connections are of smaller-sized pipe and do not require so much space as the steam lines. The steam connections then may be made as shown in Fig. 79, which is the same scheme described above for wider, single stacks. Only the returns will be differently located, as will be discussed later.

It hardly should be necessary to add that no valves should be used on the steam connections to the first row of heaters to prevent freezing the stacks. The principle on which practically all heaters are piped is that valves should be placed on every row except the first row, in order always to have the first row working to temper the air to the sections behind and to cut off the sections on the air *outlet end* of the heater *first*. If the valves are so arranged that the first row of heaters cannot be cut off until the weather is warm enough to allow the shutting off of *all* steam to the fan room, it is pretty safe to say that the danger of freezing up the sections will be very remote.

Automatic Control

Much more successful operation of heaters for blast heating and ventilating purposes can be secured by the use of automatic temperature control than by any hand control ever evolved. The additional equipment required consists of a diaphragm valve on each steam connection (except the first

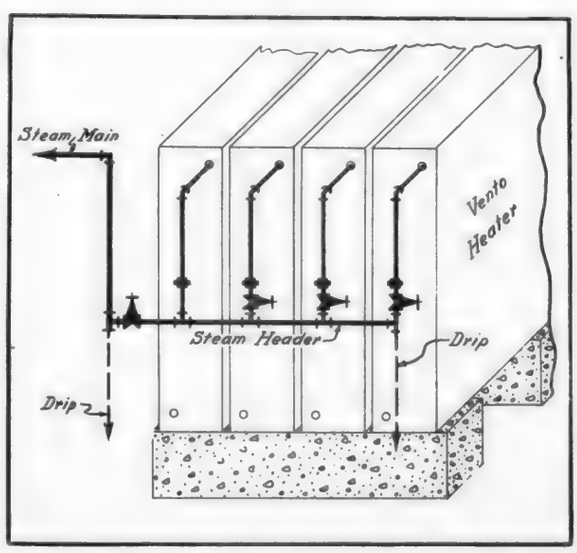

Fig. 78. Gravity Steam Connection for Vento Heaters

row) and a thermostat located at some desirable point or points to control the diaphragm valve. Usually, the specifications will state where the thermostats for each row should be placed and, for a single group of heaters, they are generally located in the plenum chamber about 4 ft. or 5 ft. back of the heater. If set too near the heater, they will be affected by the radiant heat and, if not set in the average temperature of the air flow, their action will not be correct.

It is also desirable to set them so they will not all cut off at exactly the same temperature but, instead, will cut off one after the other with a variation in air temperature of a few degrees. The reason for this will be apparent from assuming a typical case, such as a four-row heater where it is desired to deliver ventilating air to a system of ducts at or about 68° F. Now, the first row of heaters will have no individual cut-off valves, but the second, third and fourth rows will have both cut-off valves and diaphragm valves; this means that three duct thermostats will be used and these thermostats will be set in the warm-air duct some distance away from the heater, as previously explained.

If all three thermostats were set to close at exactly 68° F., then, every time the air in the duct reached 68° F., all three heater rows would shut down simultaneously and immediately, or almost immediately, the air temperature would begin to drop. As these thermostats function on about a two-degree range, as soon as the air in the duct dropped to 68° F., all three thermostats would throw all three heating rows back into full capacity operation. In mild weather this would be an "OFF" and "ON" idea with a vengeance—the heater sections would constantly be wrong. When on, they would be generating too much heat and, when off, there would be none. Consequently, all three thermostats and diaphragm valves constantly would be trying to correct an almost incorrectible condition.

But suppose the three thermostats were set as follows:—

First Row.....No Control.
Second Row....Closes at 70°, opens at 68°.
Third Row.....Closes at 68°, opens at 66°.
Fourth Row....Closes at 66°, opens at 64°.

Here is a case where, with the first row on, the second, third and fourth rows will open one after another as the outside temperature drops until, with the minimum outside temperature, all four rows are working. Whenever the first row cannot maintain 68°, the second row will cut in, and whenever the first two rows will not maintain 66°, the third row cuts in, and as soon as the three rows fail to keep the air up to 64°, the last row comes forward and does the trick.

It is true that the air temperature with this arrangement will vary from a minimum of 64° to a maximum of 72° F., but this is only 4° above the ideal of 68° and 4° below the temperature desired. As a matter of fact, the other method will not hold a temperature of exactly 68° either, as it takes 2° variation to operate the thermostat. Still, if closer regulation is desired, it may be secured by adjusting the thermostats even nearer as follows:—

First Row.....No Control.
Second Row....Closes at 68°, opens at 70°.
Third Row.....Closes at 67°, opens at 69°.
Fourth Row....Closes at 66°, opens at 68°.

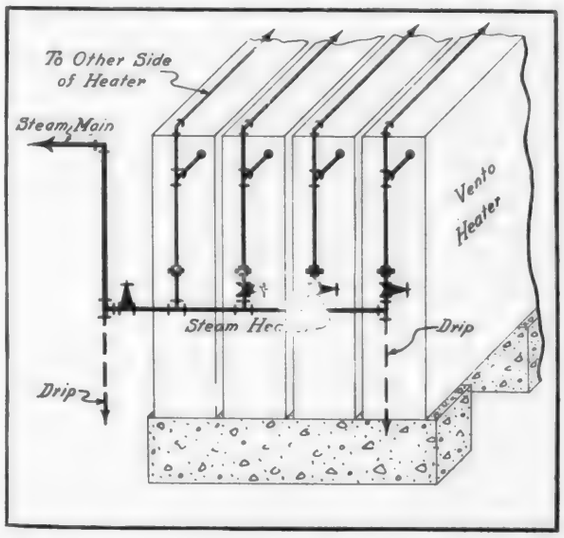

Fig. 79. Typical Connection for Double Stacks of Vento Heaters

In this case, the variation will be confined to 2° above and 2° below the desired temperature. The first setting, however, usually will be found to be quite close enough for all ordinary purposes.

Gravity Return Connections

Return connections on Vento heaters hooked up to gravity steam systems do not involve anything of very unusual character. It is desirable to bring them out of the return tapping full size and to use a reducing ell, turned down, to reduce the size of pipe to the desired diameter. After this is done, a short horizontal run is made in which a check valve and gate valve are installed; on the first row the check valve is used, but no gate valve is put in as no stop valve was placed on the steam branch to the first row.

Air venting is taken care of on the return connection and may be made by putting in a short length of vertical ¾-in. or 1-in. pipe and, after raising up a foot or so, finished off with a reducing ell and automatic air valve. It gives better results if a large-sized air valve is used, although on small stacks the common automatic air valve, such as is used on the ordinary radiator, in some cases has given satisfaction. Care should be taken in connecting up the returns to arrange them, as far as valving is concerned, in the same manner as for the steam connections. That is, if the steam

branches are valved so that one valve controls a certain bank of heaters, then a similar valve should control the same bank of heaters on the returns.

In cases where the returns must be lifted to a higher level, the receiver-return pump often is utilized, the receiver serving to collect the returns until they accumulate a sufficient quantity to raise the float and start the pump. In such cases air-venting of the receiver tank also must be provided.

Vento Heater Connections for Vacuum Work

There is little to add to what already has been said concerning steam connections on gravity systems that does not also apply to the steam connections on Vento heaters when used with vacuum systems; the chief difference lies in the fact that the drip from the steam headers must be trapped before connecting to the return line. No graduated valves are ever used and automatic control remains the same as already outlined.

Return Connections on Vacuum Systems

The returns, however, are treated in a radically different way, owing to the fact that there is no connection between the returns from the various rows, except through traps which have a higher vacuum on the return side in each case and so have no tendency to reverse the flow into the adjacent row through the return connection. Therefore, the returns may be connected up in any manner most desirable, without reference to the way in which the steam connections are made to the different rows or the valving of same.

Dirt pockets are a most desirable feature whereever traps are employed and so the first item to be taken care of on leaving the heater is a reducing ell and a dirt pocket; the dirt pocket may consist simply of a short piece of capped pipe or may be a special strainer such as is manufactured by various companies for this particular purpose.

For the sake of economy all the returns sometimes are hooked up to one single header and a large-capacity trap used to drain the headway. This does not give as good results as when an individual trap is used on each row or stack of the heater. Traps should be of the float or "blast" type and must have ample capacity to handle the condensation when steam is turned into a cold heater.

In Fig. 80 is shown a typical return connection for use with the vacuum system in which the single trap on the end of the return header is employed; the better method is to supply an individual trap for each stack. Where the stacks are set two wide, or with single stacks wide enough to require double return connections, the returns from the opposite side may be connected up regardless of the returns on the near side, and the two returns can be connected together at any point where it is convenient to do so.

Equivalent Direct Radiation for Vento Heaters

One fact which never should be forgotten in connecting up rows of Vento heaters—or any heaters used with fan installations—is that the first row is going to do more work than the second, and the second row more than the third, and so on. This of course, is because, the first row gets the coldest air and, therefore, has the highest efficiency. By far the most consistent method of sizing both steam and supply pipes for blast heaters is to compute the equivalent direct radiation for each row and then size the pipe as though it were going to feed this amount of direct radiating surface.

This means simply to compute the number of B.T.U. required to perform the heating effect attained in each row and to change this amount into E. D. R. by dividing by 240. The formula is

$$\text{E. D. R. equals } \frac{V \times 60 \times T}{50 \times 240}$$

in which V is the volume of air in cubic feet per minute, T the temperature rise in the air produced in that particular row of the heater, 60 the number of minutes in 1 hr., 50 the number of cubic feet of air heated 1° by 1 B.T.U., and 240 the number of B.T.U. to equal 1 sq. ft. of ordinary radiator surface. This formula also may be simplified to the form

$$\text{E. D. R. equals } \frac{VT}{200} \text{ or } 1/200VT$$

Suppose a heater has four rows in which the

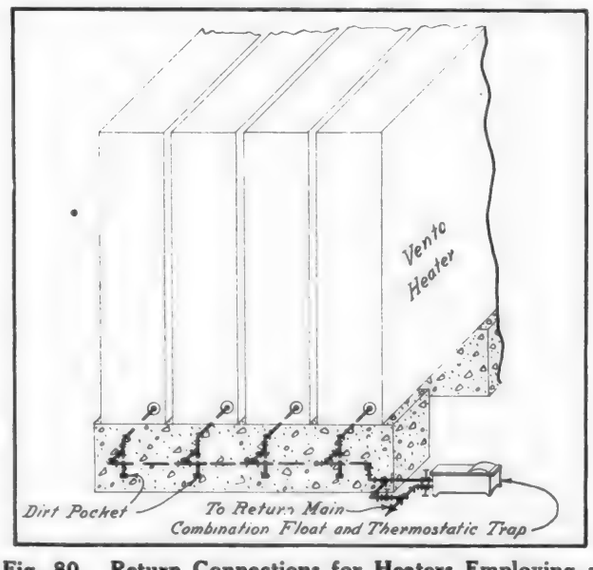

Fig. 80. Return Connections for Heaters Employing a Single Trap for the Heater

velocity is such as to produce a temperature rise per row as follows:

First Row	Zero to 30°
Second Row	30° to 50°
Third Row	50° to 65°
Fourth Row	65° to 75°

Now the heater stacks are all the same size and have the same amount of surface; they also handle the same amount of air, but their steam consumption and condensation will not be equal, one stack

with the other. Of course, the steam consumption and condensation per stack must be the same, as the condensation is only the condensed steam from the stack and is supplied only by the steam entering the individual stack and condensing therein.

To obtain the equivalent number of square feet of direct radiation which would exert the same heating load on both the supply and return lines, it is only necessary to compute by the formula the E. D. R. and to size the pipes, traps, etc., accordingly.

Using the formula in its simplified form of

E. D. R. equals 1/200 VT

and assuming the air quantity is 40,000 C.F.M. the E. D. R. for the first row is

$1/200 \times 40{,}000 \times 30$ or 6000 sq. ft.

and for the second row is

$1/200 \times 40{,}000 \times 20$ or 4000 sq. ft.

and for the third row is

$1/200 \times 40{,}000 \times 15$ or 3000 sq. ft.

while for the fourth, or last, row is

$1/200 \times 40{,}000 \times 10$ or 2000 sq. ft.

showing that the heating load in the last row is only about one sixth as much as in the first row; in actual practice the difference will not be as great as this, but it *will* be of sufficient amount to justify increasing the capacity of lines to the first row and decreasing the capacity of lines to the last row over what they would be if the total heater load simply and arbitrarily was divided into four equal parts and all connections made the same to each row.

Fin and Other Heating Surfaces of High Efficiency

In these days when, from time to time, new types of heating surface and novel designs of brass and copper radiators are being developed, the above method will aid in determining the proper size of connections to provide; it simply means that, when the air quantity and temperature rise are known, the heating load—i.e., the work done in the heater—always can be calculated to an accurate degree and reduced to equivalent square feet of ordinary cast-iron radiation which is usually assumed as having an efficiency of 240 B.T.U. per square foot, and on which all pipe sizing tables are based.

New Home-Study Course in Gravity Steam and Water Heating

(*Continued from Page* 83)

FITTINGS

Low-pressure steam heating-boilers should have for trimmings, at least, a safety valve, water column, gauge glass, pressure gauge and damper regulator.

A water boiler requires an altitude gauge, a thermometer, and it is advisable to include a damper regulator.

This lesson concludes the section devoted to boilers. The next lesson will take up the preparation of estimates and proposals for heating work.

Engineers and Contractors Agree on Steam Riser Capacities

(*Continued from Page* 65)

indicates that the velocity of 25.4 ft. was probably not the maximum which the pipe would carry. Limited available facilities made impossible further increasing condensate by use of more fans.

The 3-in. section of riser showed a velocity of 20.8 ft. per second under existing conditions, which was increased to 25.6 ft. per second with five fans, indicating that the maximum velocity possible, if sufficient radiation was available, was probably above this value. Likewise the maximum velocity for the 3½-in. pipe was shown to be greater than 27.8 ft. per second. Existing conditions gave a velocity of 29.5 and 31.9 ft. per second in the 4-in. section on different days, which values were raised to 36.8 ft. per second by increasing the radiation by means of fans.

The tests on this riser demonstrated conclusively that all sections of the riser would operate with complete satisfaction with velocities at least as high as 25.4 ft. per second, while at least one riser would so operate at 36.8 ft. per second. The data leave little doubt that if facilities were available for further increasing radiation on the different levels all sections of the riser would have carried steam with counter-flowing condensate at the velocities shown for the risers tested in the laboratory of between 35 and 40 ft. per second.

The report states: "One may conclude from the data presented that one-pipe upfeed risers free from defects, such as roughness, unreamed ends and undersize, will permit of velocities of 28 or 30 ft. per second for ¾-in. and 1-in. size, while larger pipes will permit a velocity of 35 ft. per second."

One of the principal conclusions reached in the investigation is that disturbances in a heating system, usually attributed to small risers, frequently are caused by small radiator branches or valves and that the capacity of the riser may be limited by poorly-reamed or undersized nipples or other fittings. Emphasis is laid on the fact that the capacity of a one-pipe system is no greater than the capacity of the smallest fitting through which the steam and condensate must flow. It further should be emphasized that valves and other fittings frequently do not have openings as large as those in pipes of the same nominal size.

Another significant point was brought out in the discussion of the report when H. M. Hart stated that, according to the test results, the pressure-drop in a vertical riser seems to be lower than that obtained by the Babcock formula upon which we have depended so long.

It was announced that the committee intended to continue the tests on branches from the risers to the radiators because it was found that these branches and perhaps the radiator valves had a very decided effect on the action of the riser.

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A RATING code is not a test code nor is a test code a rating code. From the letters that have been received by THE HEATING AND VENTILATING MAGAZINE, since opening its columns for constructive criticism of the low-pressure boiler-rating code recently "adopted in principle" by the A. S. H. & V. E., it is evident that there is considerable misunderstanding on this point. Almost every writer has made suggestions and comments on a test code, whereas such a code is not now up for consideration. The society adopted a boiler *test* code in 1923, and that code has since been in effect.

A boiler-rating code is a formulation of conditions under which *a* boiler rating can be determined. Not, necessarily, *the* boiler rating, but an output *at this definite point,* above and below which other outputs will be found. A rating is but an index of ability to perform under stated conditions. Under different conditions the performance may be better or worse. But the code defines the conditions, or datum line, at which a rating can be obtained, and it is the desire of the committee entrusted with this code to make the conditions equitable for all manufacturers of low-pressure heating boilers.

Manifestly, it will not be possible so to write the code specifications that every manufacturer will be happy. It must be a compromise. There must be give and take. Some manufacturers who have been characterized as "conservative" may find the middle-ground of the code leaning so far toward the conditions of rating test used by their competitors that they will be able to increase the ratings now published in their catalogs. Some of the manufacturers who have been accused of "boosting" their ratings may find that the datum line finally adopted by the committee leans so far toward the conditions of rating determination used by the "conservatives" that they must perforce lower their ratings to meet the conditions of the datum line.

The period of readjustment will be one of turmoil. There will be those who feel that their rights have been restricted and those who can, under the code, increase the catalog ratings of their boilers. But, in a characteristic American manner, this period will be short-lived and emergence into the era of uniform ratings can but prove profitable to all concerned.

All evidence points to the fact that the committee members are devoting a great deal of time, energy and money to bring to a conclusion the task that was entrusted to them. The individual members are strongly animated by a spirit of open-mindedness and fairness to all parties and particularly desire to perform a service that will benefit the public.

Final adoption of the code, as it may be modified by the committee, will establish a datum line at which a rating can be given to any heating boiler. That rating may or may not represent the optimum performance of the boiler. The code does not limit the flue-gas temperature, or anything else, under working conditions. It merely fixes certain factors for the rating test. It does not directly aid in the selection of a proper boiler for any given installation. It establishes the ability of the boiler under fixed rating-test conditions, but does not limit the performance under operating conditions. The purchaser, with full test data and the rating available, can make his own selection on any basis he pleases, or he can ordain that any boiler shall be worked at any desired flue-gas temperature. He thus can cause the boiler to produce beyond the rating established under the code, but he does not change the one basic consideration that is the backbone of the rating code—the fact that all boilers shall be uniformly rated at the same datum line, permitting of accurate comparison at that level.

The test code has long since been disposed of. We now have under consideration a rating code.

SINCE the foregoing was written, a notable meeting of representative boiler manufacturers with the A.S.H. & V.E. committee has served to clear the atmosphere regarding many points not fully understood, and the prospects for the final acceptance of the code may now be characterized as more than promising.

Why is the A. S. H. V. E. Boiler-Rating Code Called a Test Code?

ANOTHER letter, this one from a man prominent in the boiler manufacturing world, has been added to those already written to THE HEATING AND VENTILATING MAGAZINE regarding the proposed low-pressure boiler-rating code of the American Society of Heating and Ventilating Engineers.

EDITOR THE HEATING AND VENTILATING MAGAZINE:

"The question of stack temperature should not be the limiting factor in boiler rating but should be published so that a boiler can be selected to suit the kind of chimney to which the boiler will be connected. In other words, if a low inefficient chimney is already built, let a boiler be selected that will deliver gases to the chimney at a high temperature so that sufficient velocity will be created and the boiler will have a chance to deliver its output.

"A boiler with a high stack temperature naturally will have a lower efficiency, and it becomes a question whether it would be a better investment for the owner to build a chimney suitable for use with an efficient boiler with a reasonable low stack temperature, and save fuel, or to pay the additional fuel bill year after year and use his present chimney and an inefficient boiler.

"The really big question in boiler selection is the attention period. The average home-owner (and the home-owner is the big user of cast-iron boilers) is not very much interested if his smoke-pipe gets red hot for a short time when he is getting up heat. He is interested in how long he can maintain a fairly uniform fire in his boiler and keep his house warm without going into the basement to fire his boiler.

"The size and height of chimney is another factor that affects the boiler. If a boiler designed with a maximum gas travel and sufficient heat-absorbing surface to offset a low stack temperature was to be installed in a bungalow, the chimney may have to be a great deal higher than the building. This will seriously affect the outward appearance of the building. A house-owner would rather have a high stack temperature for a short time than have the appearance of his building permanently disfigured with the chimney out of proportion with his building simply because engineers and boiler manufacturers had decided for him that he should have a cool smoke pipe.

"Boiler manufacturers have very little control over the chimney to which the boiler may be connected; in fact, the manufacturer seldom knows until trouble develops what kind of a chimney is used with his boiler. The boiler manufacturers will recommend a certain size chimney for his boiler but it is a very hard matter to determine whether this chimney is tight and in suitable condition for the boiler. It is clearly a question of telling the truth about boilers without any limiting factor, and the ultimate user of the boiler should be considered because he is the man that really pays the bill and buys the fuel.

"I can see no relation between stack temperature and rating, and for the good of the industry such a limiting factor should not be considered. There is a good reason to limit the moisture in the steam on account of the danger to the boiler due to priming and the noise and inconvenience resulting from water in the steam piping. If a boiler will not deliver its output without priming, the manufacturer will either have to redesign his boiler or accept the output developed with a limited amount of priming or moisture in the steam.

"Attention to the fire in the boiler is another item that could be considered as a limiting factor. The firing periods as recommended by the Boiler Output Committee of the Heating and Piping Contractors National Association indicate good conservative judgment regarding attention which the average caretaker of a heating boiler would consider reasonable. The smaller boilers under 8 sq. ft. of grate area cover the home and small building heating field. The larger boilers ordinarily are taken care of by a janitor or fireman and a shorter firing period is not a hardship on the owner.

"The efficiency of a boiler is a factor that affects the man that uses the boiler. The home-owner wants a boiler that will heat his home and wants to get the greatest amount of heating comfort per ton of coal. The efficiency factor should be considered in selecting the boiler, but the item regarding chimney noted above shou'd be considered."

If editorial comment is in order, it might be well again to point out that the writer of this letter, in common with many others who have criticized the code, has misinterpreted the purpose of the code. In his opening sentence he says: "The question of stack temperature should not be the *limiting factor* in boiler rating. . ." (The italics are ours.) The fact is that the code as proposed, does not so state. Under the heading "Rating Definitions" it is stated: "The average temperature *during the period of test*, of the flue gases leaving the boiler, shall not exceed 700° F." (Again the italics are editorial.)

There is nothing in the intent of the code to limit the temperature of the flue gas when the owner of a boiler "opens 'er up wide" in the morning of a cold winter day. The smoke pipe may

Boiler-Rating Code Committee Meets with Representatives of Boiler Manufacturers

A SERIOUS attempt was made to iron out differences of opinion in regard to the low-pressure boiler-rating code when, at the invitation of Chairman Alfred Kellogg, of the A. S. H. & V. E. Committee on the Rating of Low Pressure Boilers, a special committee of the National Boiler and Radiator Manufacturers' Association joined his committee in an all-day meeting held at the Hotel Astor, New York, October 20.

The boiler manufacturers were represented by William Ritchie, president, and Frederick W. Herendeen, secretary of the National Boiler and Radiator Manufacturers' Association, E. W. Smith, Stanley Smith, Roger Williams, Frank Howell, H. T. Richardson and R. V. Frost. With Mr. Kellogg were his associates on the boiler-rating committee: Percy Nicholls, F. C. Houghten, L. E. Seeley, and, by invitation, Secretary A. V. Hutchinson, of the A. S. H. & V. E.

The provisions of the code, as tentatively formulated, were discussed and the suggestions made were analysed and debated. It appeared that little objection could be found to the formulation of the committee, aside from possible changes in the suggested datum lines for flue-gas temperature and CO_2. There was disclosed a decided trend toward the furnishing of performance data by manufacturers to those interested in boiler performance and boiler selection. The results of the meeting were decidedly positive and indicate that agreement on moot points will not long be delayed.

Chairman Kellogg will confer with representatives of the American Boiler Manufacturers' Association in regard to the rating of steel boilers, and with the Output Committee of the Heating and Piping Contractors National Association prior to taking up the completion of the code. He has extended an invitation, to all interested in the subject, to meet at the "open house" at the Research Laboratory, in Pittsburgh, during the week of November 7, in the hope that concurrence in the final draft of the code may be unanimous.

get red hot, as the writer of this letter suggests, and by raising the flue-gas temperature to this excessive degree the desired end may be attained. The point is that the boiler was rated at a temperature of 700°, which was *not* the limiting temperature, but the datum line, to which it is necessary to reduce all variable conditions in order that comparable results can be obtained.

Another interesting comment is that made in regard to the desirability of setting a datum line for priming, but not for flue-gas temperatures. Suppose that the essential part of the sixth paragraph of this letter is re-written, as follows, the words in italics being those replacing the original text. We have:

"There is good reason to limit the *temperature of the flue gases* on account of the danger to *the home* and the *loss that the owner will sustain from sending so much otherwise useful heat up the chimney.* If a boiler will not deliver its output without *developing high stack temperatures* the manufacturer will either have to redesign his boiler or accept the output developed with a limited *flue-gas temperature.*"

These comments are not intended to replace any ideas of the committee, but are offered because so many commentators appear to feel that the figure to be set by the code is a *maximum allowable* temperature. Witness the writer of the letter published on Page 86 of THE HEATING AND VENTILATING MAGAZINE for October, when he says:

" . . .a more efficient boiler than the one the Heating Code Committee would have us use *that would never exceed* 700° F. stack temperature. (Once more italics have been inserted to point out the error in understanding.)

Discreditable Situation Due to Lack of Boiler Code

ONE of the most startling commentaries on the results of inflating boiler ratings comes from a member of a well-known organization of consulting engineers. The writer states that the purchase of boilers, having questionable ratings, is predicated upon "*sworn proof of data from manufacturers before accepting them.*" The comments of this engineer follow:

"As designers of heating plants, we have been hoping for something better in the way of a boiler-rating code than that now proposed by the A.S.H. & V.E. Code Committee. As members of the A.S.H. & V.E., we feel chagrined that the interests which have been opposed to any code at all have succeeded to the extent that the code, as proposed, has no practical value and is a decided step backward from the old code, and decidedly inferior to the code of the Heating and Piping Contractors National Association. It is well known that some boiler manufacturers have run riot so far as ratings are concerned, and those interests which we should expect to be most conservative seem to be the worst offenders against honest ratings. As a consequence, we accept ratings of only those manufacturers who willingly give true data as to their boilers and require sworn proof of data from manufacturers of 'inflated rating boilers' before accepting them.

"It is our opinion that all reference to CO_2, so far as rating boilers is concerned, should be eliminated from the code, for high CO_2 does not always mean high efficiency, and, furthermore, the layman knows nothing about CO_2.

"Likewise, we believe the limit of 700° stack temperature is too low for large boilers, as we know of many boilers giving very good efficiencies at stack temperatures in excess of 700°. We suggest this should be raised to 800 or 900° for large boilers.

"The duration of test we feel is entirely too short, and should cover not less than two firing periods. Power boilers, which have very short firing periods and constant attendance, are usually tested over a minimum of eight hours.

"We believe the code, to be of any practical use, should require the publication of certified performance test data and manufacturer's guarantees as to outputs on the various firing periods. The code should state, definitely, a number of firing periods to be used and, particularly, one firing period basis for each size-class, to be used as so-called commercial or catalog rating.

"The code should definitely limit the chimney sizes for different sized boilers, and require the true grate area, measured at grate level, to be stated, and not camouflaged, as is often the case.

"What we need is a code that will insure the true rating of boilers, on an equal basis, so that the engineers, contractors and owners may know what they are buying. Unless the society can adopt a code that will be of use to the industry, it might better devote its time to debating the subject of 'Who Won the War?'"

New Publication

Construction and Construction Materials is the title of a bulletin issued by the Department of Commerce, Washington, D. C. This booklet contains a summary of leading developments during the year of 1926, which has been reprinted from the Commerce Yearbook for the Division of Building and Housing of the Bureau of Standards. Many charts, graphs and tables are shown of construction contract awards, value of these contracts, index numbers of building materials, prices, and construction costs.

Group Advertising of the Heating and Plumbing Industries

Group advertising is the only practical solution to our industries' major problem, viz.; how can we direct public attention our way?

When I say that group effort is the only practical solution, I do not wish to minimize the splendid individual efforts of those within our industries to affect public consciousness. I hope they continue it; but there does seem need to focus attention on our industries as an entity; in other words, let's have people thinking of plumbing and heating, let's have them weigh the advisability of buying our industries' products rather than automobiles, radios or something else.

The public has been educated to consider large industrial units—they now consider industries where they formerly considered individual manufacturers.

Now that we have definitely embarked on an advertising program, I would like to sketch briefly what has been done in this campaign and what your part will be in it.

The objectives of the campaign are two-fold; first, to direct public consciousness to the essential part the products of our industries play in the modern scheme of life; second, to further unify our industries and spur all branches of them to greater creative sales effort.

The first objective will be attained by the advertisements now being prepared by a nationally-known advertising agency. The second objective we hope to reach by the intensive "selling" of the campaign to our industries as a whole, particularly to the retail branches. Correlated advertising campaigns for associations and individuals will be ready on the release date of the major campaign. Associations and individuals will be encouraged to identify themselves with the campaign by advertising and planned sales effort. We believe that through this campaign, many in our industries will for the first time realize what a wonderful thing our industries are and that the realization will impel them to strive for the high standards of effort which our industries' position warrants.

I want to go on record as saying that we should not consider that there is overproduction until every home in the country is properly equipped with modern heating and plumbing equipment. I want to assert that the fundamental difficulty confronting our industries is one of distribution to the consumer and not one of production, and that the solution of our problem lies in the field of sales stimulation and not in curtailment of production.—*Russell G. Creviston, secretary, Program and Budget Committee, National Trade Extension Bureau, before the Eastern Supply Association, in New York, October 12-13, 1927.*

Gas Interests Recognize Potential Power of Heating Contractors

Necessity of Close Hook-Up Featured in Report of A. G. A. House-Heating Committee

DATA presented and conclusions drawn by the House-Heating Committee of the American Gas Association, in the report at its recent convention in Chicago, October 10-14, provide conclusive evidence that leaders in the drive to build up house-heating loads in more than 150 cities have awakened to the fact that heating contractors are the "key" men in their respective communities. As such, and thanks to the coherence in the gas industry, engendered by the A.G.A., the near future undoubtedly will see the gas marketing interests and the manufacturers of gas-fired boilers and auxiliary equipment united in "selling" the gas heating idea to this backbone of the heating industry.

Such concerted action will be a marked contrast to the procedure of those oil-burner manufacturers who have failed to realize the strategic position of the heating contractor, and have built up selling agencies top-heavy with overhead expense and manned with high-pressure salesmen.

It is significant of this nation-wide acceptance of the heating contractor, as the logical medium through which to do business with the home-owner, that members of the committee, making their individual statements to the chairman, without exception refer pointedly to the potential value of the heating contractor to the gas company and to the manufacturer.

Rather than attempt to phrase a consensus of these opinions, the following disconnected but related statements are taken from the report of H. Leigh Whitelaw, chairman of this committee, and from the individual reports of members of his committee.

Mr. Whitelaw, in presenting the high lights of this phase of the gas industry said:

MORE THAN 118,000 HOMES HEATED WITH GAS

"It is gratifying to report that as of July 1, 1927, there were more than 118,000 central house heating plants in use in territory served by 156 gas companies reporting in the United States of America and Canada. During the year 1927, 156 gas companies report house heating installations as compared to 71 in 1926, and more than 50 additional companies have indicated that they are beginning to promote the sale of house heating actively.

"As shown by comparison of the two years' responses to the house-heating questionnaires there was a 9% increase in the number of house-heating customers served by identical companies reporting in 1926 and 1927."

The report of a committeeman from a New Jersey city contains the following:

"We started off with an introductory dinner meeting he'd at one of the most prominent hotels in the city, to which we invited by letter all heating and plumbing contractors in our city, whom we desired to hear our first story on gas house-heating, and, in order to insure the presence of these contractors at this meeting, a follow-up call was made by our house-heating salesman, in order to arouse their enthusiasm.

"At this dinner a gas-fired boiler was set up, and a detailed explanation was given by the manufacturers and our company officials who were present, on the main points of construction, erection, operation, sales plan, and what the company would do for the customers concerning service upon and after installation. At the same time, the fact was stressed that all sales, as well as installations were to be promoted through the heating contractors.

"Immediately after this first dinner meeting with the heating trade as our guests, we followed up with a second dinner meeting at the same hotel, which was conducted in a manner similar to the first meeting, having present as our guests all architects and building contractors for the purpose of selling to them the idea of automatic temperature-controlled gas house-heating, and the advantage that gas has over other house-heating fuels.

"A number of prominent heating contractors in our city had, previous to our heating campaign, put before the people in an earnest manner the idea of automatic temperature control for house-heating, as the oil industry has been particularly active and came upon the scene in an aggressive manner, and at first a great many of these heating contractors did not take very kindly to gas for house-heating.

HEATING-PLANT SURVEY ALWAYS PRECEDES SALE

"The next important step we found in selling house-heating is to have a very careful survey made as to whether the home is adapted for gas house-heating, as no attempt should be made to sell unless certain changes are made to remedy faulty conditions provided they exist. Careful measurements must be taken of the existing, or as the case may be in the new home, of the radiation surface to be heated, in order that a careful estimate may be given of the operating costs based on the most reliable data available. Never should this estimate be lowered or a point stretched merely to put over a sale, as one unsatisfactory installation will cause more grief to the gas company and more unfavorable publicity than can be overcome in your particular community for a long time.

"As stated before, all boilers are sold through the heating trade, which naturally at first does not always take kindly to gas boilers. Upon selling a job we have a specially trained service man actually go on the job with the heating contractor and supervise the erection of the boiler; at the same time, carefully instruct the customer as to the starting, operating, etc., in general, as well as how to shut off the boiler.

EVERY HEATING CONTRACTOR HAS A FAIR SHOW

"No partiality has been shown with regard to certain heating contractors in selling our gas boilers, as we, in every case, prefer to have our customers' own heating contractors effect the installation. In this way, we gradually have brought about sales co-operation on the part of all heating contractors in our community, who are now, whenever they are requested for estimates by their customers on heating equipment, furnishing such estimates to include a gas boiler, with many architects including gas boilers in their heating specifications for new homes."

From the "Hub" comes the following brief but pointed comment:

"Two practices have been demonstrated to be wise. One is co-operation with the heating trades. The Boston Consolidated Gas Company will not set a house-heating plant except through one of the regular heating contractors.

"Assuming that the gas company has a prospect; a figure for the cost of the installation, including the fitter's price for the appliance, is obtained from a reputable heating contractor. This figure plus the price of room temperature-controls is quoted to the customer by the gas company. This makes extremely good business for the heating contractor

as the gas company pays him on the completion of the job and then collects from the customer. While not all the contractors are yet working with the gas company in fullest co-operation, those who have worked with the company in this way are more than satisfied and their number is constantly increasing.

"The contractors frequently get prospects and turn them over to the gas company. When a contractor does this it goes without saying that no other contractor has a chance to bid on that job.

"The gas company is always ready to take plans of proposed buildings from architects and builders, to design complete heating systems therefor and to submit bids on the complete installation, and many architects and builders are availing themselves of this service."

SOME POINTERS FROM CHICAGO

After an experience of four years of house heating, H. B. Johns, of Chicago, writes:

"In selecting men for the selling of central heating plants we try to hire and train men who are proficient in the three distinct spheres of our operations, namely,—the uses and application of gas, the heating and ventilating field, and selling.

"All of our installations are made by regular heating contractors. In making cases the steam fitter buys the equipment from us and sells the complete installation to the home-owner. In other cases we sell the equipment and installation complete to the home-owner and sublet the installation work to a heating contractor. We co-operate with the heating contractor in the making of sales by furnishing estimates of the cost of heating homes and in some cases by taking over a deferred payment contract for the heating contractor.

"Our co-operation with these men not only has resulted in increased sales but has enabled us to make use of their knowledge and experience in preventing and correcting faulty heating systems.

SELLING GAS BOILERS OPENS WAY FOR SPECIALTY SALES

"In making changes in old heating systems it often is desirable to take advantage of some of the various specialty devices in the heating field such as pressure systems for hot water heat, vapor vacuum valves for one-pipe steam systems, and the like."

Pittsburgh, too, finds the heating contractor invaluable, as is shown by the following:

"It is the policy of the gas company to have all jobs installed by reliable heating contractors.

"Heating contractors are allowed their percentage on the equipment that they install regardless of whether or not they sold the job."

The gas company in Stamford, Conn., feels the same way about it.

"The co-operation of heating and plumbing contractors was sought and obtained by the following sales policy:

"Gas-fired boilers and temperature regulators are sold through the heating contractor only.

"The entire installation is made by the contractor with supervision and assistance furnished by the company.

"The contractor is not called upon to give up part of his profit due to service calls for which he cannot make any charge.

"During the winter of 1926-27, 45 gas-fired boilers were operating. This equipment and its installation is all new business for the heating contractors."

E. S. Murray, of the Laclede Gas Co., St. Louis, is outspoken in his estimate of the importance of the heating contractor. He says:

"It is only within the last two years that we seem to have discovered at once that the "heating contractor" was a very dominating figure in the matter of selling central heating plants and his more active interest in house-heating by gas is now being systematically solicited. This particular phase of central heating plant promotion is one which should receive more attention, and to the company that is just beginning its central heating plant promotion work, or to any company that has not as yet organized its house-heating sales plan with heating contractor contact as an essential part of its sales program, we would say that they are overlooking an opportunity of cutting down part of the cost of their sales work. We have found the heating contractor a wonderful help. He is looked upon as the logical man from whom information as to heating appliances and heating costs are to be gotten and if you have sold him on the story of gas for house-heating you can rely on his carrying your story to his clients and to the architect in a convincing manner.

"We have been telling the advantages of gas for house-heating to the architect for a number of years, but much of the effort expended probably could have been saved if the heating contractor had been sold at the same time as the architect. The general public was appealed to and we sold them here and there: but the greatest progress has been made since the heating contractor began to see the light and recommended gas-operated heating plants to his clientele."

The report includes a voluminous tabulation of data concerning 156 cities where house heating with gas is being pushed. The table classifies all installations as steam, hot water and vapor; warm air; steam, hot water and vapor conversions; warm-air conversions.

Gas Interests Look Upon Oil-Burner Industry as Chief Competitor

Advantages of gas over oil as a domestic fuel are discussed in the report of a sub-committee of the House Heating Committee, and, except for a few questionable items, the case is fairly and completely stated.

In one place it is stated that "the life of such (oil-storage) tanks will certainly be not much more than five or six years," and, in presenting a tabulation of comparative operating costs, depreciation and repairs are set at 10% of the estimated cost of burner, tank, *boiler and stored oil.* Incidentally, the working efficiency of the oil-fired job is given as 50%, which probably is 10% to 15% low. It is unfortunate that inaccuracies like these are permitted to appear in such statements, as always there is likely to be the feeling that other parts of the arguments are correspondingly weak. By making up a balance sheet of the relative costs of heating a home with 500 sq. ft. of steam radiation in Portland and in the eastern part of the country, the committee shows annual costs to be $492 for oil and $466 for gas, in the former location, and $324 and $318, respectively, in the latter section. It is doubtful if these figures could be justified, say, by comparative data from 100 typical installations, and questionable figures hurt even the best cause.

Another questionable statement is: "There is a distinct fire hazard with oil. Gas is the safest of all fuels". Where definite and incontrovertible data are not available to substantiate such a statement, it would seem better omitted.

It was stated editorially in THE HEATING AND VENTILATING MAGAZINE, months ago, that the coming battle for the domestic house-heating loads will be between the gas and oil interests, and the activities in the A. G. A., together with this committee report, serve to prove the truth of this prophecy.

House-Heating Appliances Approved by A. G. A. Testing Laboratory

Central house-heating appliances, that have been approved by the testing laboratory of the American Gas Association, are given in the following list, which is correct to October 22.

August 1

American Radiator Co., New York, Ideal 1-G-7

Bryant Heater & Mfg. Co., Cleveland, O., Bryant 8-S-4

Payne Furnace & Supply Co., Inc., Beverly Hills, Cal., Payne 3

September 1

McLaughlin Sheet Metal Works, Sacramento, Cal., McLaughlin 500

October 1

B-Line Boiler Co., Cleveland, O., B-Line 65

Peerless Heater Co., Pittsburgh, 7-S-3 Peerless

Richmond Radiator Co., New York, Heatomat 8 AW

When Experts Disagree—

Observations of an Onlooker at the Meeting of the Public Health Engineering Section of the American Public Health Association Convention

AT the meeting of the Public Health Engineering Section, held during the annual meeting of the American Public Health Association, in Cincinnati, October 18, there were presented a number of papers dealing with such subjects as "Standardization of Pasteurization Plant Requirements," "Present Requirements and Procedure of Washing Milk Bottles," and "Sanitary Construction and Arrangement of Milk Pasteurization Plants." One paper, under the title "Recent Developments in (School) Ventilation Studies," was read by Thomas J. Duffield, executive secretary, New York Commission on Ventilation, as a progress report of the special Committee on Heating and Ventilation that was appointed at the last annual meeting.

It was significant that there was more discussion on Mr. Duffield's presentation than there was on any of the preceding excellent papers on the pasteurization of milk and cleaning of milk bottles. The inability of experts to agree upon code requirements for clean milk bottles should make everyone present view the attempt to establish agreement on ventilation practice with a new understanding of the very serious and important difficulties involved.

Mr. Duffield's report was largely extracts from letters relating to the proposed school ventilation investigation at Rochester, N. Y. They tended to show that the central committee representing all of the bodies concerned had agreed upon a procedure that the health of the pupils involved should be taken as a measure of the value of the method of ventilation; that Willis Carrier, representing the American Society of Heating and Ventilating Engineers' Committee agreed to this resolution, subject however to acceptance by his associates, which acceptance was withheld. Hence the proposed investigation seemed to be hopelessly blocked.

The report touched upon excessive temperature differences found in one and two-story school buildings in Cattaraugus County, New York. It mentioned progress of studies that the New York Commission is making in schools at New Haven, Conn., and Syracuse, N. Y., and it mentions the possibility of extending these studies to Cleveland, O.

VENTILATION STUDIES NOW IN PROGRESS

Referring to the present activities of the New York Ventilation Commission, Mr. Duffield said:

> IN view of the wide public interest in the school ventilation problem, as discussed at the recent meeting of the American Public Health Association, Dean F. Paul Anderson, president of the American Society of Heating and Ventilating Engineers, was asked by THE HEATING AND VENTILATING MAGAZINE to record his impressions of the section meeting at which the report of the Committee on Heating and Ventilation (of schools) was presented. Quick to sense the vital points of the discussion, Dean Anderson, in his report of this meeting, has given, in a few words, a very clear picture not only of the viewpoints presented but of the atmosphere of the meeting itself.

"The committee has been interested in the studies in New Haven, Conn., Syracuse and Cattaraugus County, N. Y., of the effects of different types of ventilation on the health of school pupils. The first of these has been conducted under the direction of Dr. Leonard Greenburg, while the latter two are field studies of the New York Commission on Ventilation.

"The results of the New Haven and Syracuse studies, which were of a preliminary nature and should not be clothed with greater reliability than the methods warrant, are in agreement to an astonishing degree in confirming the findings of the New York State Commission on Ventilation, that from the angle of the health of the pupils, as indicated by the incidence of respiratory illness, natural ventilation (where local conditions permit its use), is superior to that accomplished by mechanical means under average conditions of operation.

"These studies are being continued during the present school year under conditions that should produce thoroughly reliable data not only as the incidence of respiratory illness but as to the air conditions as well.

"In the Cattaraugus County study, which was restricted to one and two-room rural schools, the numbers of individuals under the various conditions were so small and the conditions so varied and variable, that there was no apparent relationship between air conditions (as indicated by dry-bulb temperatures) and respiratory illness among the pupils.

"An impression of the air conditions in these rural schools may be gained from analysis of the data collected by the commission's observers on the occasion of their visits to the schools.

"The average temperatures were:

(1) Ceiling 85.7° F.
(2) Breathing level 69.7° F.
(3) Floor 58.1° F.

or an excess of 27.6° F. at the ceiling over that at the floor.

"A single observation showed the following temperatures at the different levels:

(1) Ceiling 116° F.
(2) Breathing level 77° F.
(3) Floor 61° F.

"The average of several observations in a single school showed temperatures at the 42 in. level to be 24° higher than at the floor. In another school the average of the ceiling temperatures was 102.5° F. while that at the breathing level was 77.8° F. or an excess of almost 25° F. at the ceiling. These figures are cited to give a picture of the vertical heat distribution. Laterally, similar conditions exist and it will suffice to mention that in one school the temperature on top of one occupied desk was 40° F. lower than on another in the same room.

"The discovery of these conditions has led the commission to the adoption of the following policy toward the Cattaraugus County study during the coming winter.

'1. The collection of data regarding dry-bulb temperatures, health and attendance by the teachers will be continued.

'2. These records will be supplemented by observations of relative humidity, floor, ceiling and desk-top temperatures as frequently as is consistent with other phases of the program.

'3. The major activity of the commission's observers will be to collect data in some five or six schools in which by combinations of more adequate heating units with various types and degrees of weather proofing, a serious effort will be made to maintain air conditions generally considered more conducive to health than these found during the past year.'"

Prof. C.-E. A. Winslow followed with certain statements indicating that the New Haven and Syracuse studies were confirming to a surprising extent the original findings of the New York Commission on Ventilation. Also, he said that the disagreement at Rochester was due to insistence, by the engineers' representatives, that results be judged by

its synthetic air chart and that this chart lacked a scientific basis and is prejudiced in favor of mechanical ventilation by the conditions it recognized.

Dr. Leonard Greenburg, who is making the New Haven studies, explained that at a temperature of 68° F. the influence of humidity and air motion had less effect, and he attempted to show that so-called window ventilation was a simplified practice in school-room air supply. The impression seemed to be very definitely established that commercial considerations were prompting the engineers to refuse to accept the proposed procedure at Rochester. At this point Howard E. Sproull, who is a member of the A.S.H. & V.E. made a most effective statement that the engineers were no more influenced by commercial considerations than any other professional people, that they were only interested in ascertaining facts without prejudice. Mr. Sproull's very pertinent remarks cleared the atmosphere most thoroughly.

Dr. Peter H. Bryce, of Toronto, past-president of the A.P.H.A., in his remarks brought out the fact that the resolutions passed at the St. Louis convention, urging the abrogation of school-ventilation laws based on the 30 cu. ft. per minute standard, were passed by the main body of the American Public Health Association without the endorsement of the Public Health Engineering Section which refused this endorsement. Also he said that appointment of the Committee on Heating and Ventilation was the result of a desire to get at the facts in the question without intent to promote any particular method of ventilation. The chairman, Doctor Emerson, of Philadelphia, closed the discussion by stating that the Committee on Committees undoubtedly would continue the Committee on Heating and Ventilation.

Two thousand years ago some wise old stoic said, "Men are tormented by their opinions of things rather than by the things themselves." It is evident from many of the statements made at this meeting that there is a great deal of opinion that would be altered considerably by a discarding of suspicion and a heart-to-heart talk among those immediately concerned with no other thought than the public service that will be rendered by clearing up the confusion that at present exists. There is no question that every one concerned wants the same thing. That thing is, "What will best promote the children's health?" The differences and the resulting confusion arise from opinion as to details. These differences can be dissipated. There is no question at all as to that. And the final attitude of this meeting promises continued effort to iron out differences and to promote co-operation for the mutual welfare of every one concerned.

House-Heating Featured at Convention of American Gas Association

A NUMBER of papers on the heating of homes with gas, together with a voluminous report of the Association's House-Heating Committee, featured the ninth annual convention and exhibition of the American Gas Association, held in Chicago, October 10-14, with headquarters at the Stevens Hotel. As usual, a prominent place was given to the exhibits which occupied a part of two floors of the hotel, among the papers of special interest to heating men were:

"The Laboratory—To-day and To-morrow," by R. W. Gallagher, chairman, Laboratory Managing Committee; president, East Ohio Gas Co., Cleveland, O.

"Are We Anywhere Near Saturation?" by R. M. Searle, president Rochester Gas and Electric Corp., Rochester, N. Y.

"Large Volume Water Heating," by H. J. Long, The Kompak Co., New Brunswick, N. J.

"House Heating Developments During the Past Year," by H. Leigh Whitelaw, chairman, House-Heating Committee; vice-president, American Gas Products Corp., New York, N. Y.

Reports were made for the Competitive Fuels Committee by Chairman R. H. Staniford, Brooklyn Union Gas Co., Brooklyn, N. Y., and for the Sub-Committee on Cost and Method of providing for a Gas House-Heating Load Equal to Present Maximum Sendout on Distribution System, by Chairman M. I. Mix, Peoples Gas Light and Coke Co., Chicago.

Among the exhibitors of house-heating products were the following:

A. G. A. exhibit.

American Gas Association Laboratory, Cleveland, O.

American Gas Products Corp., New York, N. Y., gas, steam, and warm-air heaters.

American Schaeffer & Budenberg Corp., Brooklyn, N. Y., indicating and recording instruments.

Armstrong Cork & Insulation Co., Pittsburgh, Pa., insulating materials.

Bailey Meter Co., Cleveland, O., steam flow meters.

Bristol Co., Waterbury, Conn., indicating and recording instruments.

Bryant Heater & Mfg. Co., Cleveland, O., gas heating boilers.

Celotex Co., insulating materials.

Cleveland Gas Burner & Appliance Co., Cleveland, O., gas burners.

Cleveland Heater Co., Cleveland, gas heating appliances.

Clow & Sons, James B., Chicago, Gasteam radiators.

Columbus Heating & Ventilating Co., Columbus, O., gas, warm-air furnaces.

Combuston Utilities Corp., New York, N. Y., combination gas and oil boilers.

Fisher Governor Co., Marshalltown, Iowa, steam traps.

Foxboro Co., Inc., Foxboro, Mass., indicating and recording instruments.

Hoffman Speciality Co., Waterbury Conn., heating specialties.

Honeywell Heating Specialties Co., Wabash, Ind., automatic controls.

Johns-Manville Corp., New York, N. Y., insulating materials.

Linde Air Products Co., New York, N. Y., welding and cutting equipment.

Lovekin Water Heater Co., Philadelphia, Pa., water heaters.

Mears-Kane-Ofeldt, Inc., Philadelphia, Pa., gas heating boilers.

Minneapolis Heat Regulator Co., Minneapolis, Minn., automatic controls.

Mueller Co., Decatur, Ill., heating specialties.

Mueller Furnace Co., L. J., Milwaukee, Wis., gas heating boilers.

National Tube Co., Pittsburgh, Pa., pipe exhibit.

Peerless Heater Co., Pittsburgh, Pa., gas heating boilers.

Reznor Mfg. Co., Mercer, Pa., gas heating equipment.

Richmond Radiator Co., New York, N. Y., heating boilers.

Scientific Heater Co., Cleveland, O., gas heating apparatus.

Time-O-Stat Corp., Milwaukee, Wis., automatic controls.

Titeflex Metal Hose Co., Newark, N. J., metal gas tubing.

Universal Smokeless Boiler Co., Ravenna, O., heating boilers.

U. S. Bureau of Mines, Washington, D. C.

Victaulic Company of America, New York, N. Y., pipe couplings.

Analysis of Insulating Materials

In a table published in THE HEATING AND VENTILATING MAGAZINE for October, Page 89, an analysis was given of insulating materials covering their commercial form, commercial thickness, density, commercial conductivity, resistivity, and cost per 1000 sq. ft. In the case of Thermocrete, the resistivity per inch thickness was given as 2.5 and in another place as 5.2. The correct figure is 2.5. The figures for Corkboard were correctly given as 3.31 for 1-in. thickness, but for 2-in. thickness the correct figures are 6.62, instead of 6.92. Again, for ¾-in. Fibrofelt the resistivity constant is 2.35, instead of 3.13. The original figures were taken directly from the report of the American Gas Association and now are being revised.

National Warm-Air Heating and Ventilating Association announces its mid-year meeting at the Urbana-Lincoln Hotel, Urbana, Ill., November 30 and December 1. Selling-research and publicity will be the special features at this meeting.

How Would You Do It?

THE problem presented last month for solution is given in the next column.

This problem involves the determination of the resulting temperature and humidity of a mixture of air in unequal amounts and at two different temperatures and relative humidities. By the terms of the problem the total quantity of air to be considered is 10,000 cu. ft. per minute.

As one-quarter, or 25%, of this air is taken from the outside, the quantity so obtained is

¼ of 10,000, or 2500 c.f.m.

and the amount taken from the inside, or recirculated, is three-quarter, or 75% so,

¾ of 10,000, is 7500 c.f.m.

Owing to the fact that the relative humidity of the mixture depends on the temperature of the mixture, it will be necessary to compute the temperature of the mixture first and then figure the relative humidity after this temperature is determined.

One of the simplest ways to handle this is to change each quantity of air at its initial temperature into "foot-degrees" by multiplying the number of cubic feet by the temperature in degrees, then adding these two quantities together and dividing by the total number of cubic feet involved, thus:

2500 cu. ft. × 60° = 150,000 foot-degrees

and

7500 cu. ft. × 70° = 525,000 foot-degrees

adding together gives 675,000 foot-degrees and dividing by the total air quantity results in

675,000/10,000, or 67½° F.

This is the temperature of the mixture of air as called for in the problem.

Having obtained the final temperature of the mixture, the matter of relative humidity now may be taken up. In the first place, relative humidity, of course, is the percentage of moisture contained in the air when compared to the total amount of moisture which the air could contain at any given temperature.

Thus, if air at, say, 50° has only one-half the moisture in it, which could be carried at this temperature, then the air is said to have 50% relative humidity, whereas, if it had only a quarter of the moisture it could carry at this temperature, it would be said to have 25% relative humidity. Should the same air with the same moisture be reduced in temperature to a point where the air could contain no more moisture on account of its lower temperature, then it would be said to save 100% relative humidity, this state being commonly termed "saturated."

Moisture in air is generally expressed in "grains" (which are 1/7000th of a pound) per cubic foot, or per pound, of air. As the problem is in cubic feet, grains per cubic foot will be used in the calculations.

Question 3

If a fan handling 10,000 cu. ft. of air per minute is arranged with the dampers so as to take three-quarters of its suction air by means of recirculation and one-quarter of its air from the outside, what will be the temperature of the air delivered by the fan when the outside air is 60° F. and 50% relative humidity and the recirculation air is 70° F. and 40% relative humidity? Also what will be the relative humidity of the air as delivered by the fan?

Air at 60° F., when saturated or fully loaded with water vapor, can carry 5.74 grains of water per cubic foot; consequently, at 50% relative humidity, the quantity of water vapor would be

50% of 5.74 grains, or 2.87 grains per cubic foot.

Air at 70° F. when saturated can carry 7.98 grains per cubic foot, so at 40% relative humidity the number of grains will be

40% of 7.98 grains, or 3.19 grains per cubic foot.

This means that the outside air, amounting to 2500 c.f.m., will have a total moisture content of

2500 × 2.87 grains, or 7175 grains

and the recirculation air will carry a total moisture content of

7500 × 3.19 grains, or 23,925 grains.

All the water present in the whole 10,000 c.f.m. is then represented by the sum of these two amounts or

7,175 grains
23,925 grains

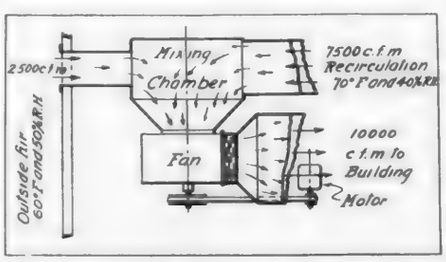
31,100 grains

and this amount of water distributed and mixed into 10,000 c.f.m. of air will give in each cubic foot of air

31,100/10,000, or 3.11 grains per cubic foot.

This quantity of moisture in air at 67½° F. can be changed into relative humidity by dividing the quantity of moisture contained in the air by the maximum quantity it could contain if saturated. Reference to tables of saturation show that air at 67½° F. can carry 7.44 grains, so

3.11/7.44 equals 41.8% relative humidity.



Fan Problem Presented in Question 3

CAN YOU SOLVE THIS PROBLEM?

The question for next month is a good one and few heating experts will be able to answer it without doing a little figuring first. Here goes:

Problem No. 4

A radiator normally supplied with steam at 2 lbs. gauge pressure and containing 40 sq. ft. of surface is supplied through a pipe of given diameter. The steam pressure is cut down until it has an absolute pressure of 2 lbs. Will the velocity of steam through the same size of supply pipe be increased or diminished, and by what per cent? Be sure to allow for the reduction in radiator efficiency when the steam pressure drops and the temperature of the steam lowers, and assume 240 B.T.U. per square foot as the efficiency under the normal 2 lbs. gauge pressure.

Growth of District Heating in Cleveland

"Street steam" is attaining popularity in Cleveland, according to a story in The CEICO Motor, published monthly by The Cleveland Electric Illuminating Company. From it, the following is taken:

"Growth of the company's steam heating system in the downtown area presents an interesting picture in comparing service to-day with that of three years ago. A review of figures shows that in 1911 the system was serving 175 downtown customers, the company delivering 346,500,000 lbs. of water in the form of steam that year. In 1924, immediately before the East Twentieth station went into operation, the number of customers had increased to 337 and the amount delivered to them had reached 1,597,788,000 lbs. The steam department now reports a total of 504 customers and during the year between July, 1926, and July, 1927, delivered 2,126,000,000 lbs. of steam, approximately a 33% increase over the last figure. In 1924, the company's steam mains extended 10 miles through the business district. Now over 14 miles of lines are in use.

"Illuminating steam-heating service, in the central business district between East 24th Street and West 9th Street, has grown so that 90% of the buildings there now depend upon the system. Whole blocks, in some cases, have completely abandoned individual heating plants and are utilizing central-station service."

Minneapolis and Honeywell Merge

Announcement is made of the merger of the Minneapolis Heat Regulator Company and the Honeywell Heating Specialties Company under the name of the Minneapolis-Honeywell Regulator Company. Both the Minneapolis plant in Minneapolis, Minn., and the Honeywell plant, in Wabash, Ind., will continue in operation, as at present. The Minneapolis company was organized in 1885, and the Honeywell company some years later. Both concerns are engaged in the manufacture of temperature and other regulating devices. Each one has played a prominent part in the development of the domestic oil-burner industry.

The capitalization of the new company consists of $2,000,000 of 7% cumulative convertible preferred stock of $100 par value and 130,000 shares of common stock of no par value. The preferred shares are priced at $99.50 and the common at $32.50.

Deaths

JESSE COOGAN, president of the Jesse Coogan Engineering Co., Salt Lake City, Utah, died recently in New York City. Mr. Coogan was one of the best-known heating men in the Far West, and was located in Salt Lake City for the past 15 years. He was a member of the Chamber of Commerce and Knights of Columbus.

RAGNAR L. KJERNER, vice-president and director of Baker, Smith and Co., New York, died September 6. Mr. Kjerner was born in Stockholm, Sweden, May 17, 1870, and was graduated in 1889 from the Swedish Technological Institute. After military service with the Swedish Government, he came to America in 1892, settled in Boston, and entered the employ of the Walworth Mfg. Company. In 1899 he became connected with Baker, Smith and Company, and remained with the company up to the time of his death.

HERBERT E. JENNISON, of the Jennison Co., Fitchburg, Mass., died September 7, from heart disease. He was born in Templeton, Mass., May 27, 1860, and, after a public school education, became associated with his father in business. A few years afterward he made his first business venture, a partnership with James Mack as Mack & Jennison, selling stoves and small steam heating plants. Later he bought out Mr. Mack's interest and operated the company alone. In 1895 he organized the Jennison Company, operating it for 30 years, during which time it grew into one of the largest steam-fitting, mill piping and sheet-metal companies in New England. Three years ago he relinquished the active management of the company, but continued as president. Before the World War, Mr. Jennison bought the Blake Pump & Condenser Company which he reorganizd and the new company then produced high-pressure power pumps for hydraulic work. Until three years ago he was an officer and owner of the Blake company.

Latest Additions to List of Approved Domestic and Industrial Oil Burners

THE following additional oil burners, it is announced, have been listed by the National Board of Fire Underwriters since May 1, 1927, up to October 11

Listed	*Name Manufacturer or Submittor*	*Class*	*Number*	*Remarks*
5/6/27	Super "Type T" Super Oil Heator Co., Hartford, Conn.	Mech. D.	MP 168	See also: Super "Type B" 3/19/26
5/31/27	Northern "Model M" Northern Oil Burner Co., Minneapolis, Minn.	Nat. D.	MP 243	See also: Northern "Model U" 3/31/26 Formerly: Northern Machinery Company
6/10/27	Baldwin "Type A-1" Baldwin Aerifactor Oil Burner Co., Inc., Baldwin, Long Island, N. Y.	Mech. D.	MP 295	
6/10/27	Serve-Well "Type T-1" Serve-Well Appliances Co. New York, N. Y.	Mech. D.	MP 309	Formerly: National Appliances Installations, Inc.
6/14/27	Franklin "Type F" Franklin Mfg. Corp., Philadelphia, Pa.	Mech. D.	MP 275	
6/17/27	Combustion "Type I" (Industrial) Combustion Fuel Oil Burner Co., Milwaukee, Wis.	Mech. D.	MP 355	
6/30/27	Ballard Junior "Type C" Arthur H. Ballard, Inc. of Mass., Boston, Mass.	Mech. D.	MP 139	See also: Ballard "Type A" 6/23/25 Formerly: Ballard Oil Burning Equipment Co.
6/30/27	Ballard "Type A" Ballard Oil Equipment Co., New York, N. Y.	Mech. D.	MP 372	
6/30/27	Berggren "Type A" Berggren Engineering Corp., Brooklyn, N. Y.	Mech. D.	MP 329	
6/30/27	Commonwealth "Type RU" Commonwealth Engineering Co., Division of Drying Systems, Inc., Chicago, Ill.	Mech. D.	MP 196	
6/30/27	Dahl "Type B-1" Dahl Oil Burner Corp., New York, N. Y.	Nat. D.	MP 297	
6/30/27	Hi-Lo "Type UX" Gloria Light Co., Chicago, Ill.	Mech. D.	MP 287	
6/30/27	Home Comfort "Type MA-2" Home Comfort Heater Co., Philadelphia, Pa.	Mech. D.	MP 331	
6/30/27	Arcoil "Model UL" Jacobson Mfg. Co., Newark, N. J.	Mech. D.	MP 291	
6/30/27	Johnson "Type B" S. T. Johnson Co., Oakland, Calif.	Mech. D.	MP 218	See also: Johnson "Type 26-A" 6/29/26
6/30/27	Lammert & Mann "Model OU" Lammert & Mann Co., Chicago, Ill.	Mech. D.	MP 299	
6/30/27	Pascoe "Type A-1" The Wm. H. Pascoe Co., Inc., Chicago, Ill.	Mech. D.	MP 345	
6/30/27	Phelps "Type A" Phelps Mfg. Co., Geneva, Ill.	Nat. D.	MP 294	
6/30/27	Pioneer "Type P" Pioneer Automatic Oil Burner, Inc., Brooklyn, N. Y.	Mech. D.	MP 361	
6/30/27	Hart "Type D" W. B. Wilde Co., Peoria, Ill.	Mech. D.	MP 160	See also: Hart "Type C" 11/25/24

Listed	Name Manufacturer or Submittor	Class	Number	Remarks
6/30/27	Rickard "Type A" Rickard Engineering Corp., New York, N. Y.	Mech. D.	MP 363	
8/23/27	Orr "Type A" Orr Engineering Corp., New York, N. Y.	Mech. D.	MP 338	
8/30/27	Bear "Type UL" Bear Oil Burner Co., Inc., York, Pa.	Mech. D.	MP 176	
8/30/27	Wayne "Type B" Wayne Company, Ft. Wayne, Ind.	Mech. D.	MP 98	See also: Wayne "Model W" 8/14/25
8/30/27	McIlvaine "Type A" McIlvaine Burner Corp., Chicago, Ill.	Mech. D.	MP 342	
8/30/27	Peerless "Model E" Levene Motor Co., Peerless Oil Burner Co., Philadelphia, Pa.	Mech. D.	MP 378	
9/2/27	Cabinet "Type 202-B" Cabinet Burner Co., Indianapolis, Ind.	Nat. D.	MP 346	
9/2/27	Red Devil "Type UL" The Loesser Company, Newark, N. J.	Mech. D.	MP 377	
9/2/27	Marr "Model E-1-H" & "Model G" Marr Oil Heat Machine Corp., Minneapolis, Minn.	Mech. D.	MP 245	See also: Marr "Type E" 3/26/26
9/2/27	May "Type A" May Oil Burner Corp., Baltimore, Md.	Mech. D.	MP 166	See also: May "Type L" 4/1/25
9/9/27	Torridheat "Model U" Cleveland Steel Products Corp., Cleveland, Ohio.	Mech. D.	MP 369	
9/9/27	Lawrence May "Types M-G-R" The Lawrence May Oil Burner Co., Flushing, N. Y.	Mech. D.	MP 397	
9/9/27	Summerheat "Type S" Summerheat Corp. of America, Dowagiac, Mich.	Mech. D.	MP 209	Formerly: The Beckwith Co.
9/13/27	May "Type A" (Industrial) May Oil Burner Corp., Baltimore, Md.	Mech. D.	MP 274	See also: May "Type C" 7/1/26
9/16/27	Winslow "Type U" (Industrial) Winslow Boiler & Engineering Co., Chicago, Ill.	Mech. D.	MP 317	
10/4/27	Johnson "No. 16" Johnson Oil Burner Mfg. Co., Muncie, Ind.	Nat. D.	MP 188	
10/11/27	Fluid Heat "Type O" The Fluid Heat Corp., Baltimore, Md.	Mech. D.	MP 337	

Proposed Federal Specifications Issued for Drafting Work

Specifications covering drawing instruments and triangles, sensitized cloth, printed tracing cloth, ruled drawing paper, detail drawing paper, and T-squares, have been drawn up by the Federal Specification Board of the Bureau of Standards, Washington, D. C.

The materials covered represent commercial commodities purchased by the various departments and establishments of the United States Government.

The specifications, as drawn, are being submitted to representative manufacturers for their comment and criticism. The Federal Specifications Board, it is stated, would be glad to receive any comments or suggestions as to changes which may be thought to be desirable in the specifications. Such comments or criticisms, however, should be in the hands of the Federal Specifications Board not later than November 26.

Special Air Delivery of Radiation

Delivery of heating equipment by airplane has been introduced in Minnesota. R. B. Mosher, pilot, representing the Minneapolis branch of the Modine Mfg. Co., Racine, Wis., transported an 11-lb. Thermodine concealed radiation unit to a St. Cloud, Minn., contractor. This small copper unit, which is the heating equivalent of approximately 370 lbs. of cast-iron radiation, is being used in the new St. Cloud Masonic Temple. Thus, it seems that a new development in heating fits in well with the latest development in transportation—the airplane.

New Engineering Building for Chicago

The new Engineering Building under construction at Wacker Drive and Wells Street, Chicago, it is announced, will be ready May 1, 1928, and the owners state that up to June 1, 43.4% of the rentable space has been leased before the site even has been cleared of the old building. Up to October 1, 55% of the building has been rented.

In every detail this new building has been designed to meet the needs of the engineer and assist him in promoting desirable contacts. The building has all the facilities that an engineer will require—physical equipment that supplements his own, libraries, laboratories, drafting rooms, auditorium, lecture rooms, clubrooms, permanent engineering exhibits, and many other features.

The structure will be 25 stories high, and a ground floor space will be arranged for shops and stores. The library of the Western Society of Engineers will be located in the building, with a completely indexed collection of reference works, catalogs, periodical publications, and other works.

New Engineering Building in Chicago

Legal Decisions

Steam Heating Pipes Installed by Owner in Mill Become Part of Realty and Pass to Purchaser Thereof

The purchaser of a mill building sued the vendor to recover the value of pipes in a steam heating system in the building, which had been removed by the vendor after the sale and sold as junk. The vendor claimed that the pipes were reserved, under the terms of sale, with right of removal. The contract of sale contained a reservation of the "equipment in said mill." The trial court found that the pipes were not included in the term equipment, and that the heating system was a fixture, and realty, and not a trade fixture; that it was installed as a permanent fixture to the freehold and with no intent that it was to remain personal property. These findings and the conclusions of law following thereon, the Michigan Supreme Court, Kent Storage Co. v. Grand Rapids Lumber Co., 214 N.W. 111, found to be correct, and affirmed judgment for the plaintiff for the cost of replacement as of the time the pipes were removed. The Supreme Court said: "It may clarify thought on the subject to recall that the term 'fixture' necessarily implies something having a possible existence apart from realty, but which may, by annexation, be assimilated into realty. Whether it retains the character of a chattel fixture or loses such and becomes realty depends upon the application of principles of law to particular facts. In considering legal principles applicable to this case, it should be kept in mind that the heating system was installed by the owner of the building. This has a direct bearing upon the subject of intention, for it will be presumed the owner intended the heating system as an accessory to the realty and a lasting benefit thereto, and it will not be presumed that the owner of the fee intended the heating system as a mere temporary improvement, to be removed as a chattel in case of sale of the land. See Tyler v. White, 68 Mo. App. 607.

"It is a salutary rule that whatever is affixed to a building by an owner in complement, to facilitate its use and occupation in general, becomes a part of the realty, though capable of removal without injury to the building. The act of an owner of a building in annexing a fixture manifests his intention of whether it is to remain a chattel or become an accession to the realty and not his secret undisclosed intention.

"Clearly, under the contract of sale, right to remove 'the balance of the machinery, belting, shafting and equipment' related solely to chattels and not to the heating system. Cases involving machinery and trade fixtures are of little help."

The heating system was installed and used by the owner as an outfit of the building and complement of the real property.

The court cited in support of its decision the following cases: Quinby v. Manhattan Cloth & Paper Co., 24 N. J. Eq. 260; Tyler v. White, 68 Mo. App. 607; Keeler v. Keeler, 31 N. J. Eq. 181; Capehart v. Foster, 61 Minn. 132; Levenson Wrecking Co. v. Hillebrand, 93 Misc. 530, 157 N.Y. Supp. 515; Realty Associate v. Conrad Construction Co. 185 App. Div. 464, 173 N.Y. Supp. 25. These cases, with many others on the same subject are analyzed in the series of articles on Heating Plants as Fixtures.

Air Heating Rates

In a suit to enjoin the enforcement of rates for electric service, the Idaho Power Company, among other grounds for relief, assailed as being arbitrary and beyond the authority conferred upon the Public Utilities Commission by the Idaho State statutes certain rate schedules established by Order 939; i.e., Nos. 6 and 6-A, Water Heating; 7, Air Heating. The water heating rates, six-tenths of a cent for No. 6 and one cent for No. 6-A, were held noncompensatory and therefore invalid. As to the air heating rates the court decided as follows:

"For intermittent use, within narrow limits, electric heating appears to be economically feasible, but not so for continuous general use in house heating. Upon that point the parties are agreed. But because plaintiff's predecessors built up an open-air heating business, particularly in one locality, the commission held that customers whose premises are equipped for this kind of service 'should not be denied the use of surplus power at reasonable rates.' Accordingly it established a schedule of rates (No. 7) available only to existing installations and applicable only to such surplus power as plaintiff might have over and above its requirements for other purposes. Taking cognizance of the overlapping of the irrigation and heating demand in the spring season, it limited the right to require service for heating at the scheduled rates to the period between September 30 and the first day of the following April, and imposed an additional charge for such service at other seasons. The schedule is made up of what is termed flat rates; that is, a prescribed amount for six months' service, ranging from $24.05 for such period to $217.10 depending on the load in k.w.

"We are convinced that the rates are insufficient to cover bare operating costs, and for that reason the schedule is held to be invalid." Idaho Power Co. v. Thompson, Idaho, S. D. Federal District Court, 19 Fed. (2nd) 547.

Steam Heating Company Not Bound to Heat Only Small Portion of Building

The owner of a building containing business premises and living rooms, partly unrented, contracted with a steam-heating company that if it would furnish heat for the rooms which would be rented during the ensuing winter season, she would arrange thereafter to install a separate heating system for the building, and discontinue service from the company. The company complied with the agreement. The owner then changed her plans and notified the company that, being a public utility, it would have to furnish heat thereafter. The company refused to furnish heat for only some of the rooms, and offered to heat the entire building, which offer was refused. The Montana Public Service Commission holds that the owner was estopped from changing her position and demanding a service which she has represented she would not desire. A public utility and its customer have a right to agree between themselves as to discontinuance or suspension of service, and when this is fairly done, in return for a good consideration (in this case in return for partial service undertaken and furnished by the utility) the Commission will not disrupt the arrangement.

The Commission thinks it unreasonable to require a steam heating utility to furnish heat to two, three, or four rooms in a building of eight or twelve rooms. Such a service encourages waste of product, would tend to defeat the utility's right to recovery in full for heat furnished, and might promote improper use of the utility's service.

Contract to Install a Satisfactory Steam-Heating System—Full Performance

In an action to recover the amount alleged to be due on a contract to install the plumbing, gas-fitting and hot-water systems, as well as a satisfactory steam-heating plant in a two-family house being constructed by the defendants, the complaint alleged full performance. There was no allegation of waiver, and recovery was not sought on the theory of substantial performance. The defendant's answer was a denial. The trial court found that the contract was fully performed in all respects, and that the plaintiff was entitled to recover the contract price. The New York Appellate Division, Goros v. Pirk, 222 N.Y. Supp. 335, stating the facts as above, reversed this decision for the following reason: "To perform this contract it would have been necessary to install at least twelve radiators. The plaintiff testified that but four radiators were installed by him, although he knew that several more were required to properly heat the premises. It was not only established by the evidence of defendants' witnesses, but admitted by the plaintiff, that the contract was not fully performed."

AIR CONDITIONING

Dew-Point Temperature of Air Mixtures

Data Sheet No. 20-H gives the moisture content for corresponding dew-point temperatures and is used in the solution of problems involving the resultant dew-point temperatures of various air mixtures.

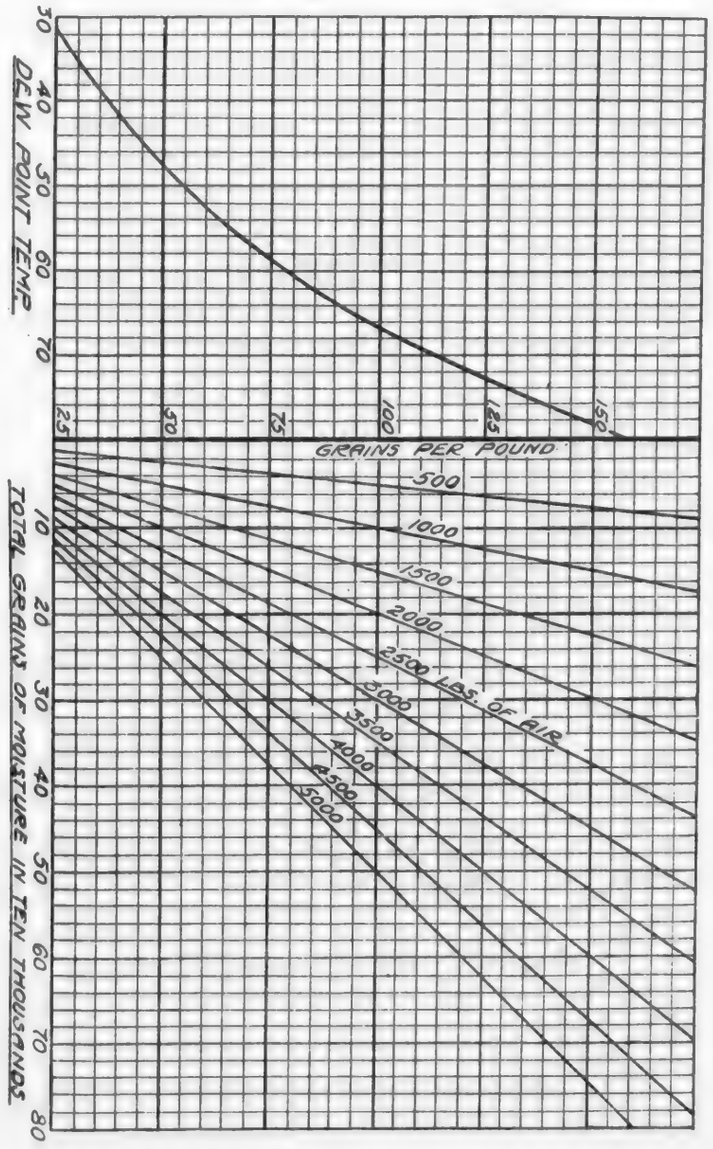
Example: Consider that 1000 lbs. of air, saturated at 48° F. at the outlet end of a cooler, mixes with 3500 lbs. of air at 75° F. dry-bulb and 65% relative humidity. What is the dew-point temperature and moisture content of this mixture? First locate 48° (the temperature of saturated air at the cooler outlet) on the dew-point scale, at the left of the chart, and pass vertically upward to the curved line, and then horizontally to the right until the 1000-lb. line is reached. From this point drop vertically downward to the grains of moisture scale and read 5. A dry-bulb temperature of 75° F. and a relative humidity of 65% corresponds to a dew-point temperature of 62½° F. Therefore, follow the same procedure on the chart for 3500 lbs. of air at 62½° F. dew-point and read 30. The sum of 5 and 30 is 35. Locate this figure on the grains of moisture scale, pass upward to the 4500-lb. line (total weight of moisture), and then horizontally left to the curved line. Drop from this point to the dew-point temperature scale and read 60° F., which is the dew-point temperature of the air mixture.

Now locate 60° F. on the dew-point temperature scale, pass vertically upward to the curved line and horizontally to the right until the grains of moisture per pound scale is reached, and read 77½ grains of moisture per pound of air.

O. W. Armspach

AIR CONDITIONING—How to Use Chart of Dew-Point Temperature of Air Mixtures | No. 20-I

AIR CONDITIONING



AIR CONDITIONING—Dew-Point Temperature of Air Mixtures | No. 20-H

Correspondence

Conducted by T. W. Reynolds

Solution Offered as Arbiter in Garage Heating Problem

EDITOR HEATING AND VENTILATING MAGAZINE:

I have entered into a friendly argument with another person as to the heating of a public garage by steam and am writing to see if you will kindly act as arbiter on the matter. The conditions are as per enclosed sketch.

I would appreciate a schedule of radaation requirements for each room, also the required grate area of the boiler, as well as the size of chimney necessary.

Attleboro, Mass. E.A.B.

Here is a problem requiring good judgment rather than good figuring. There are a lot of doors to this garage and there is no telling how long and how often these doors are going to be left open. Three air changes, as assumed for the structure in question, certainly require a lot of radiation and right here is the factor which easily may bring about a very decided difference between the computations of any two heating engineers.

The problem can be solved apparently by figures, but the result is apt to give more radiation than can be placed in the spaces available, so, in cases like this, we figure it all out, but are usually content to get in what radiation we can, or, we figure it out and then put in a partial amount of the figured requirements as determined by our judgment of the conditions.

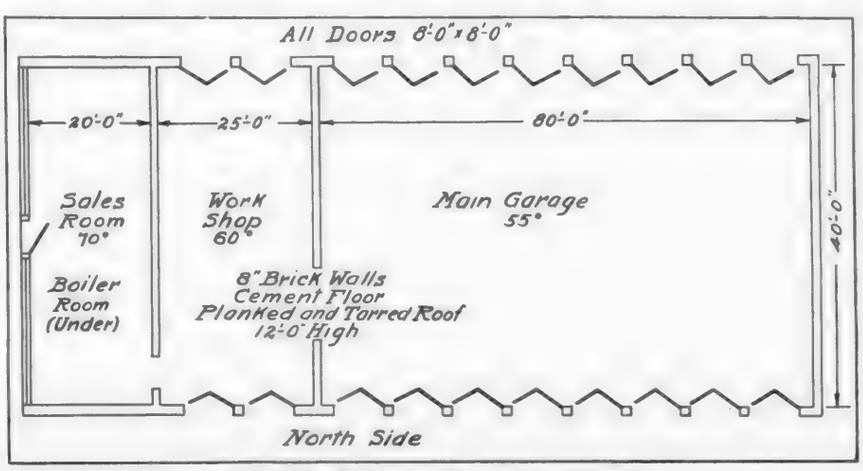
SOLUTION OF PROBLEM OFFERED BY ONE ENGINEER

Just to see, as a matter of worthwhile information, what results would be arrived at by someone else, this problem was also presented to an engineer who is not in any way connected with THE HEATING AND VENTILATING MAGAZINE. The answer came back in the form of the required square feet of radiation for the sales room, work shop and main garage, as 368,239 and 818 sq. ft. respectively, the difference from the calculations made elsewhere herein being due largely to the engineer's method of assuming only one air change, instead of three, for the work shop and main garage. This assumption was made, at least in the case of the main garage, on the reasoning that this room contained quite a large volume in proportion to its area of exposed walls, hence would not be likely to have more than one air change.

An analysis of the detailed figures accompanying this engineer's answer showed that he used the factor 1 for both glass and doors and that the additions for exposure were only 10%, except for the main garage, which was 15%. However, the factors for exposure were in effect really larger than the ones used in the calculations which follow because of the fact that the engineer applied these factors to the entire loss, including the losses due to air change and roof exposure. In the latter case it was reasoned that the roof might be pitched and, therefore, exposed to wind pressure.

In the method which follows the exposure factors are applied only to the glass and wall losses of an exposed side and not to the losses due to air change, because the number of air changes which were assumed was arrived at partly on the basis of such exposure and properly would include the infiltration loss for such exposure. Incidentally, the assumed number of air changes were checked against certain well-known infiltration tables, based upon so many cubic feet of air entering per linear foot of fixed and movable crack of doors and windows. The total cubic feet of air infiltration, as figured by this method, corresponded to an air change of the cubic contents of about three, and this did not even take into account the additional air which would enter, due to the use of the doors.

It may be said that the addition for exposure is only an arbitrary assumption, anyway, so that one engineer has as much right to his method of applying it as some other engineer has for his own method. Furthermore for the sake of quick figuring and reasonable accuracy, few engineers include the floor or partition walls, or figure doors separately from glass, as these items are of small moment. For example, the engineer referred to did not do so, nor did he take into account the increased efficiency of radiators when standing in air at less than 70° F.



Sketch of Garage Heating Problem

METHOD PROPOSED BY WRITER FOR CALCULATING THE HEATING REQUIREMENTS

Assumptions due to lack of the necessary information: Outside walls of plain brick, inside partition walls of 8-in. plain brick, roof flat of 1-in. wood with from 5 to 8-ply paper, tar and gravel, floor of 4-in. concrete on cinder fill and doors of 2-in. wood, each with 25 sq. ft. of glass.

If walls are plastered, the heat loss constant would become 0.40, or 0.28 if furred and plastered. This would make quite a difference in the required amount of radiation, in the last case.

The ground temperature was taken as 50° F., as is usual.

CALCULATIONS FOR SALES ROOM

Walls, north and south, (480 sq. ft. x 0.42 x 70°) + 20% on north wall only for northern exposure ..... = 15743
Glass, east wall, (480 x 1.1 x 70) + 10% for eastern exposure = 40656
Roof, 800 x 0.28 x 70..... = 15680
Cubic contents, 1½ air changes, 9600 cu. ft. x 0.0182 x 70 x 1½ = 18345
Partition wall, 480 x 0.42 x 10° = 2016

Total B.T.U. loss..... = 92440
92440 ÷ 240 = 385 sq. ft.

CALCULATIONS FOR WORK SHOP

Doors, north and south, (156 x 0.42 x 60) + 20% on north wall ..... = 4324
Glass, north and south, (100 x 1.1 x 60) + 20% on north wall ..... = 7260
Walls, north and south, less glass and doors, (344 x 0.42 x 60) + 20% on north wall = 9536
Floor, 1000 x 0.28 x (60 — 50) = 2800
Roof, 1000 x 0.28 x 60 ..... = 16800
Cubic contents, 3 air changes, 12000 x 0.0182 x 60 x 3..... = 39312
Partition, 480 x 0.42 x 5°..... = 1008

Total ..... = 80032
Less heat received through partition of sales room..... = 2016

Total B.T.U. loss..... = 78016
78016 ÷ 240 = 325 sq. ft.

However, the required amount of radiation will be slightly less because each square foot of radiation will transmit more heat when standing in air at 60°. In other words, the rate of transmission from a radiator is in proportion to the difference in temperature between the steam in the radiator and that of the air of the room.

The rate of transmission from a direct cast-iron column radiator is generally accepted as 240 B.T.U. with steam at 220° F. and room at 70° F. Then 220 — 70 = 150° temperature difference, which, divided into 240 equals 1.6 B.T.U. per degree of temperature difference. Now there is a variation in the rate of transmission of about 2% for each 10° increase or decrease variation from the standard temperature difference of 150°, hence 1.6 + 2% = 1.1632, which, multiplied by 160° gives a transmission of 261 B.T.U. per square foot of radiation in 60° air. Therefore, 78016 B.T.U., as calculated above, when divided by 261, will give the required amount of radiation, which is 298 sq. ft., instead of 325 sq. ft.

CALCULATIONS FOR MAIN GARAGE

Doors, north and south, (624 x 0.42 x 55) + 20% on north wall ..... = 15855
Glass, north and south, (400 x 1.1 x 55) + 20% on north wall ..... = 26620
Walls, north and south, less glass and doors, (896 x 0.42 x 55) + 20% on north wall = 22768
West wall, (480 x 0.42 x 55) + 15% for eastern exposure = 12752
Roof, 3200 x 0.28 x 55..... = 49280
Floor, 3200 x 0.28 x 5..... = 4480
Cubic contents, 38,400 x 3 x 0.0182 x 55 ..... =115315

Total ..... =247070
Less heat received through partition of work shop..... = 1008

Total B.T.U. loss..... =246062
246,062 ÷ 240 = 1025 sq. ft.

However, radiation is in 55° air, hence, proceeding as before, 1.6 + 3% = 1.648, which, multiplied by 165° gives 272 B.T.U. per square foot. Therefore, 246062 ÷ 272 = 905 sq. ft.* as the required amount of radiation.

SIZING THE BOILER

To obtain the boiler tax, or load on the boiler, it is essential that all radiation be changed to equivalent direct radiation, that is, the result must be expressed in terms of radiation transmitting 240 B.T.U. per square foot, as the ratings of boilers are for so many square feet of radiation at 240 B.T.U. For example, 385 + 325 + 1025 = 1735 sq. ft. total load in equivalent direct radiation and a boiler having a rating of, say, 75% additional capacity would be selected, thus 1.75 × 1735 = 3036 sq. ft. of boiler rating. If this is not clear, then add the total B.T.U. transmission, divide by 240 and then add 75%. If this is done, the same result will be obtained.

Boilers produce their rating under test conditions with clean boiler heating surfaces, proper attention, adequate draft and good coal, hence a percentage must be added to take care of practical conditions, such as poor coal, poor firing, unclean surfaces and chimney of inadequate size and height. The smaller the boiler the less attention is it given, and sooty surfaces result, as is well known to be true of the average home installation, therefore the percentage to be added increases as the radiation load decreases.

The boiler also must be able to produce results when steam first enters cold radiation and results in maximum condensation, tests showing as much as three and one-half times the normal rate at the end of ten minutes from initial entrance, with gradual reduction from this rate to normal only at the expiration of 25 minutes. Again, the boiler must be able to supply the steam condensed by the piping, usually an amount equal to 25% to 30% or more of the total direct radiation installed, the exact amount depending upon the size of the job. This percentage to add for piping has been verified time and again and is obtained by adding together the heat loss from covered and uncovered piping and boiler, remembering, of course, that each square foot of surface of a single horizontal pipe loses much more heat than 1 sq. ft. of cast-iron radiation. So it will be seen from all this that it is necessary to add a percentage to the load to get the boiler rating, not necessarily because boilers are overrated, but rather because it is necessary to provide for actual conditions as they exist, as well as to add a factor of safety, the same as in all branches of the engineering profession.

To obtain the size of grate areas required we are not concerned with the total boiler tax or load, but rather with the load imposed by all condensing surfaces, thus 1735 sq. ft. + 30% for piping load (as much of the pipe will be in 55° or 60° air) = 2169 sq. ft. Under practical conditions we may only get 60% efficiency from the boiler, which, with good coal at 13,000 B.T.U., would be 60 × 13,000, say, 8000 B.T.U. realized per pound of coal. If we are able to obtain a higher efficiency, and it is often done, we are still by that much conservative and safe in our figuring, for, after all, we may receive coal with a lower heating value than 13,000 B.T.U., say 11,400 B.T.U., so that with a higher efficiency of 70% we would still realize only 8000 B.T.U. per pound of coal.

Reasoning thus, we proceed as follows: (2169 sq. ft. × 240 B.T.U.) ÷8000 B.T.U. realized per pound of coal = 65 lbs. of coal that must be burned hourly. Now the rate of combustion per square foot of grate can be increased with the degree of attention given the boiler and the size of the boiler. Usually, for medium size installations, as in this case, it will not be desirable to burn over 8 lbs., but for residential work it is better to vary the rate downwards from 8 to 6 lbs., according to the conditions.

If a grate is sized on this basis it means that normally and for a greater part of the heating season it will not be necessary to burn at the above rate, though at the time of the quick pick-up load for cold radiation it will be necessary to increase the rate of combustion, something which can readily be done for such short and infrequent periods.

Therefore, 65 lbs. ÷ 8 lbs. burned per square foot of grate = 8.13 sq. ft. of grate required, or, more conservatively, 65 ÷ 7 = 9.3 sq. ft. of grate area. A boiler selected on such a basis will probably have a rating equal to the load plus 75%, but, in any event, the boiler should at least have the grate area as calculated. At the same time, it should be remembered that the grate should not be too large, otherwise during mild weather it will be necessary to run the fire at an extremely low rate of combustion, which means a fire difficult to control and hold down because of its thinness.

Another point is that the boiler should have the requisite fuel capacity, enough to burn at the desired rate, yet not be fired for, say, 8 hrs., as in residential work. In larger installations, where the

*Wall or pipe coil radiation transmits much more heat. If used, divide the total B.T.U. loss by 314, 336, or 346 for 70°, 60°, or 55° air, respectively. The quotient will be the required square feet of wall or pipe coil radiation, thus 295 sq. ft. for the sales room, 232 sq. ft. for the work shop and 712 sq. ft. for the main garage.

boilers receive more attention, the firing period can be considerably shortened. Thus, the boiler in question should have a fuel capacity of (65 lbs. × 8 hrs.) ÷ 33⅓% for rekindling reserve = 694 lbs. of fuel capacity, the rekindling reserve being the amount of coal which must be kept at the expiration of 8 hrs. in order to fire the next charge of coal. Therefore, a boiler should be selected having the requisite fuel capacity, as well as the necessary grate area.

If an old boiler which satisfactorily has carried the load, is to be replaced by a boiler of another make and the load is unknown, the boiler should not be replaced on a rating for rating basis, but rather on the basis of a boiler having a grate of equal area and a fuel capacity of equal amount to the one replaced.

The size of the chimney can be calculated but it is a laborious process, one which will not give as accurate results as the tabulated data in catalogs which feature the particular boiler selected. Such data are based partly on manufacturers' tests, which show the draft necessary to overcome the resistance of the gases in passing through his boiler, and partly on the experience of the manufacturer with his boiler in practice. Using this method with a certain make of boiler gives a chimney size of 16 in. × 16 in. × 45 ft. high for the grate having about 8.13 sq. ft. of area and 16 in. × 20 in. × 50 ft. high for the grate having about 9.3 sq. ft. of area.

If the height of the chimney is not all that it should be, then the area of the chimney should be increased, or if the chimney area or height is not right, then increase the size of grate so that a thinner fire can be carried due to the larger grate area. This method requires less draft or chimney height due to the increased resistance of the thinner fuel bed.

A round chimney having a diameter equal to a side of the square chimney will serve just as well. It is also well to remember when selecting a flue of proper area that rectangular tile flue-linings have less inside area than would appear, due to the size by which they are commonly known.

In commenting upon the reply here given, our correspondent makes some interesting comparisons between the various figures which were submitted in connection with this problem. For ease of comparison these figures have been tabulated as follows:

Estimated Square Feet of Radiation

	Sales-room	Work-shop	Main Garage	Total
First engineer	368	239	818	1395
The Heating and Ventilating Mag.	385	298	905	1588
Correspondent	400	307	1050	1757
Second engineer	400	307	1050	1757
Third engineer	...	...	...	1500
Fourth engineer	...	...	...	950

Dividing a Smoke Flue to Increase Its Capacity

EDITOR HEATING AND VENTILATING MAGAZINE:

I am submitting herewith a sketch of a double flue which is only 30 ft. high, but which is to be connected to a low-pressure boiler of 10,000 sq. ft. rating.

I have had a discussion with two engineers about this flue. They claim that inasmuch as the pulling power is double that of a single flue it will give equal efficiency, even though it is less than one-half the required height.

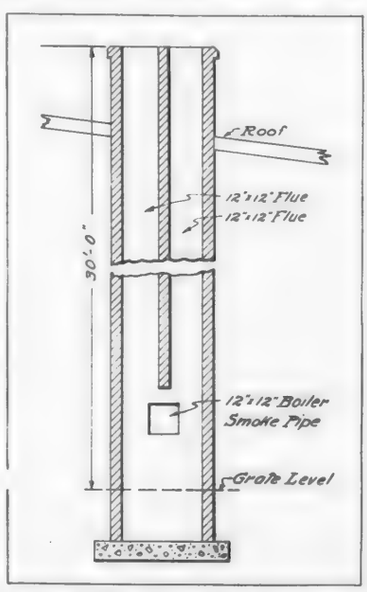
Knoxville, Tenn. J. A. AHLER.

If the claim of the two engineers were true we could keep on cutting down the height of the 30-ft. flue while correspondingly increasing its area until its height was only 1 ft., in which case its area would be 60 sq. ft., or we could eliminate its height altogether by standing the boiler in the open, thus letting the flue be the width of the universe.

In water heating work the motive head for circulation is usually slight. We try to get all the head available, knowing full well that increased pipe area will do but little to help out if the head is not right. Even where we have a very large motive head we do not decrease pipe sizes to any appreciable extent, because of our fear of frictional losses thereby set up. The cases are parallel, so why expect more of a chimney than one would of a hot water heating plant?

There is practically only one height and only one area for any chimney. For example, if the height as required to overcome resistances of fuel bed, boiler, and so forth, is 60 ft., then we need 60 ft. of height, irrespective of the area; but if the height required to give the proper intensity of draft is only 30 ft., then we only need 30 ft. of height. In either case we need the same area.

We cannot increase the height from 30 to 60 ft. and at the same time decrease the area in a corresponding measure, as from that obtained by two 12-in. x 12-in. flues to that as obtained by one 12-in. x 12-in. flue. If the two flues comprise the total area required for capacity, then the smaller area of the lone flue would increase the velocity of the gases to such an extent that the resulting friction losses would decrease the draft as much or more than the draft obtained due to the additional height.



Smoke Flue Divided to Increase Its Capacity

If we attempt to offset the disadvantages of an extremely low chimney by using a flue of great size we slow up the gases and thus cut down the frictional losses to the extent that slightly less intensity of draft is required. However, we may cause the gases to move so slowly that they will travel up one side of the large flue while cold air falls down the other side to kill what little draft is left. This sometimes happens where the area of a flue is made large enough to take care of future boiler capacity. It is much more likely to happen where there is a partition dividing the flue into two parts, but very few engineers would take a chance on such a method, even though the flues were of the proper area.

Where two adjacent existing flues are to serve as one it is a good plan to break away the dividing wall as far as one can reach at top and bottom of flue. This will tend to give the entering gases an initial velocity across the full chimney area before meeting the dividing wall and likewise will cause downdrafts as they enter at the top to be diffused somewhat over the cross section. If this is not done the downdrafts easily may encounter one of the flues and pass down that flue with resulting troubles. Even where this method is carried out, the best that can be said for it is that sometimes such flues work and sometimes they do not. They are uncertain in their action and no one can guarantee the results.

Incidentally, it should be noted that the perimeter or friction surface of the flues in question is one third greater and the effective area is 20% less than if the dividing wall were eliminated, the effective area being considered as equivalent to a diminution of the area by an amount equal to a lining of inert gas 2-in. in thickness. It should be further noted that this chimney should be about 30-in. in diameter by 70 ft. high for the given load.

Another point to keep in mind is that chimneys under 36 ft. high are uncertain or erratic in action. The head produced by such a low height is so small that the least unfavorable condition or interference practically puts the chimney out of commission. At best the head produced by chimneys up to 64 ft. in height is so small that the draft is frequently affected by surrounding conditions.

A great deal of confusion and misconception exists in regard to the true meaning and nature of draft and an element of mystery surrounds its application to chimney design, yet does anyone know of an engineering problem that has been covered with more literature?

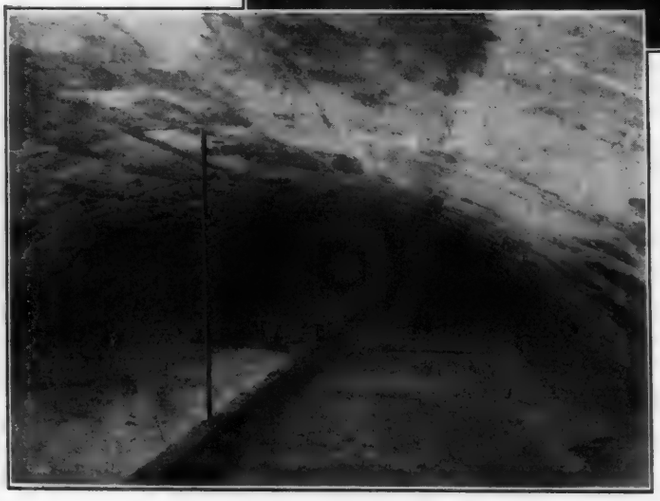
HOLLAND

Now Open

New vehicular tube under Hudson River, between Manhattan and New Jersey, to be opened for traffic at noon November 12.

(Above) One of the Four Ventilating Towers Containing Battery of 15-Ft. Fans.

(At right) Looking Down One of the Tunnels Showing Exhaust Outlets at Top.



Construction of Exhaust Air Duct Above Roof of Tunnel

Relay Board in Control Room of New York Land Ventilation Building

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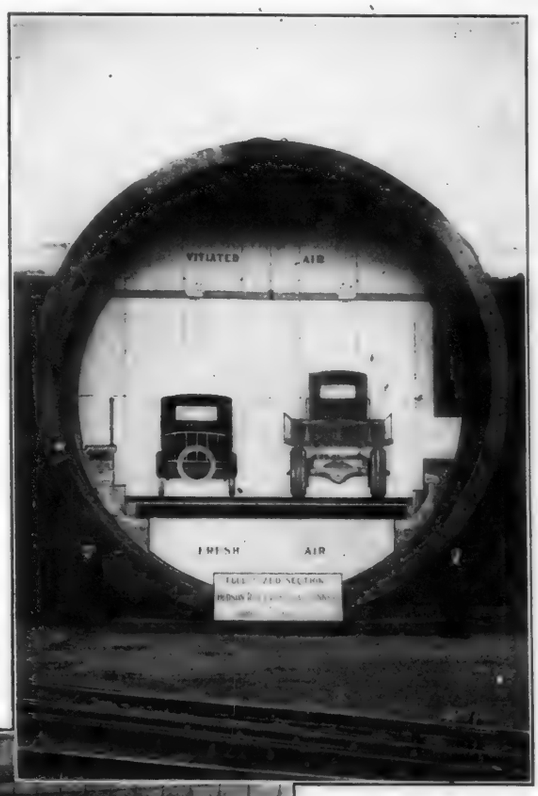
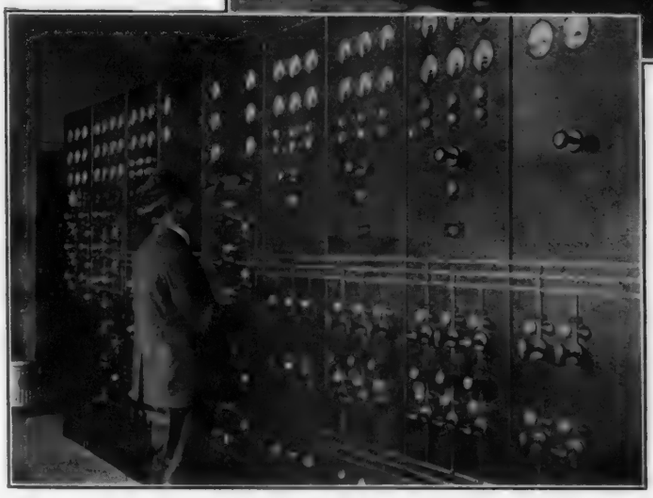
TUNNEL
To Traffic

The entire ventilating system consists of 80 batteries of fans, half of which supply the tunnels with fresh air and half exhaust the vitiated air.



(Above) Full-Sized Section of Holland Tunnel 29 Ft. 6 In. in Diameter.

(At Left) Fresh Air Slot at Side of Tunnel.



Air-Flow Control Board in New York Land Ventilation Building

One of the Exhaust Fan Units in New Jersey Land Ventilation Building

Copyright International Newsreel, Pacific & Atlantic Photos, and courtesy of Holland Tunnel Commission.

Glancing Backward

High Lights in the Evolution of Leaders in the Heating and Ventilating Industry

II—*The Ric-wiL Company*

AMERICAN industrial activities teem with examples of important manufacturing concerns whose origins have been the nebulous ideas or "schemes" of a dreamer. A tremendous factory, with acres of floor space, is devoted to making the little paper drinking cups that, unknown ten years ago, now are used literally by the million. This is but a single example of the crystallization of an idea; every field of endeavor has outstanding examples, and the heating industry is no exception.

Nearly twenty years ago G. B. Hannaman became interested in some deposits of infusorial earth or diatomite, found near Los Angeles, Calif. This class of material had been used extensively in Germany, France and other foreign countries, for heat insulation, and the art of its application was developed to a high degree. J. H. Wilson, of Indianapolis, an associate of Mr. Hannaman, was one of the pioneers in underground insulation, and, having made some improvements in pipe-covering design, decided to use diatomite as his insulation. He formed an alliance with Glendon A. Richards, of Grand Rapids, Mich., and they began work on the manufacturing problem, securing diatomite from Mr. Hannaman's concern, later to become the present Celite Products Company.

The basic idea, upon which future development hinged, was the application of diatomite to the insulation of underground pipes, where a peculiar condition controlled the situation. Both during installation and during the life of an underground steam line, it is practically impossible to keep the insulating material dry. Consequently any substance that deteriorated under repeated wetting and drying would not be suitable for this purpose.

ADAPTABILITY OF DIATOMITE TO UNDERGROUND PIPES

Diatomite seemed to have been produced, in nature, just to fill this particular want of man. It is an excellent thermal insulator, and, while it absorbs water readily, the drying-out process leaves it exactly as before. Consequently, with an appreciation of these facts, the two prime movers began to lay plans for adapting diatomite to underground pipe covering.

It was common practice, in those early days, to use magnesia pipe-covering, and to install this covering of such diameter that an annular space of 1 in. to 2 in. was left between the pipe and the covering. It was generally felt that, if this annular air space was closed at the ends of the covering, it afforded additional insulation practically equal to that of the covering. Tests made, about 15 years ago, on a 6-in. steam pipe carrying 125 lbs. pressure, where the annular air-space was blocked off every 27 in. by 1-in. collars of insulating material, indicated that the idea was not sound, and that the space was of little value as an insulator.

In the early stages of their association, Messrs. Richards and Wilson accepted the prevailing idea, and, under the name of the Richards-Wilson Pipe Covering Co., of Grand Rapids, Mich., started to design and manufacture glazed tile conduit that would hold the diatomite securely and be waterproof when installed. A feature of the design provided for construction on a sectional basis, so that installation, repairs and salvage would be facilitated.

The business grew with encouraging rapidity and, to mark the product, a trade name, composed of the first three letters of the name of each of the firm members, was coined and Ric-wiL products became an increasingly important factor in underground pipe work. Eleven years ago the corporate name was changed to The Ric-wiL Company.

SOLUTION OF DRAINAGE AND SUPPORT PROBLEMS

In addition to providing for a watertight conduit system, it was evident that there should be incorporated in the design a scheme of drainage that could be cleaned out when necessary, and there also was apparent the desirability of a supporting element that would hold the conduit in alignment. Contact with engineers in the ceramic industry developed the application of an invert which had been designed for use in built-up sewers, as a kind of key block. Mr. Wilson solved this problem by the design of an interlocking construction in which there was provided an opening in the center of each inverted block, each section of conduit resting on two inverts. Prior to starting the manufacture of this product, it was submitted to engineers familiar with underground work, and the encouragement received from this broadcast led to large production plans.

The first Ric-wiL system placed on the market, 17 years ago, included a special tile with interior surface roughened to hold the diatomite liner in place when the conduit was split apart. The bottom half of the conduit had a projecting ledge on each side of the line of fracture, and, after the top half had been placed in position, a soft elastic cement was troweled onto the ledge, closing the joint. The bell joints of the conduit also were cemented with the same material. Internal pipe supports made of cast-iron, in the form of an inverted arch, were pushed into the diatomite 10 ft. apart, and solid steel rollers were used for the steam pipe to rest on.

Interlocking base-drain units were used to support the conduit, as is done to-day, but it was not until 1918 that centering lugs were incorporated in the design to form a cradle for the conduit. This element proved an important factor in increasing the strength of the conduit.

DEVELOPMENT OF LOC-LIP SIDE JOINT

After two or three years of experience it was found that, under certain conditions, the elastic cement would expand enough to form small pockets that would catch water and permit it to seep through the conduit joint. So the natural thing was done—the ledge that had caused the trouble by forming a gutter and catching water was removed from the bottom half of the casing and placed on the top half, where it formed an eaves-like protection against this kind of trouble. Elastic cement was used with this construction on account of the ease with which the pipe could be inspected, although it was recognized that hard cement would add to the strength of the conduit. About 1918 a change was made to a conduit cross section having increased thickness at the joint, forming a wide cementing surface, the intent being to use hard cement. This did not prove entirely satisfactory on account of the difficulty of insuring uniform and high-class workmanship at all times, and the inventive genius of the organization again was prodded.

The Loc-liP side joint, brought out in 1925, made it possible to use the desired heavy cement mortar, and the design increased the supporting strength of the conduit materially. Fractured edges of top and bottom halves are put back together without cement between, making a perfect "metal-to-metal" seat; the mortar

is then troweled between the locking lips, resulting in a strong, visible, watertight side joint.

From the very beginning of this highly-specialized endeavor it has been the policy of the organization to meet special requirements with specific designs to best fit the situation. For instance, with excessively wet ground conditions, the Type SPC conduit, having double drainage, is used. Here the conduit joints are a safeguard against water entering between manholes, but in case of flooding through the manhole, the necessary drainage is provided.

Such special conditions as are met in construction under and near railroad tracks have produced cast-iron conduit, similar to the clay Ric-wiL tile, but with ribbing for additional strength.

The latest development is the production of a waterproof insulating filler for conduit, composed of South African asbestos given a treatment that makes it water-repellent. It is said to be entirely non-capillary, and even if kept submerged will not absorb water. It is non-corrosive, and tests indicate a thermal conductivity of 0.358 at 150° F.

It is said that a poor underground pipe job is one mistake that will not stay buried, so that the constant aim must always be to provide insulation for underground steam pipes that need not be disinterred for failure to properly perform its functions. In providing equipment of increasing worth and striving always to advance the art, these pioneers have earned an enviable position in the industry.

Detroit Lubricator's Fiftieth Anniversary

OLD-TIMERS in the heating industry will be interested in the fact that 1927 marks the fiftieth anniversary of the founding of the Detroit Lubricator plant, well-known for its precision manufacture. It is hard to realize that this plant, modern in design, building and equipment, and one of the industrial landmarks of "Dynamic Detroit," is celebrating its half-century anniversary, having been founded in the year 1877, or that it could have built up, entirely from within, from an organization of 5 to 1600 employees.

The Detroit Lubricator plant, as an industrial entity, is older than the parent organization — the American Radiator Company—and is one of the chief divisions of the "Arco" group. The factory is still producing lubricators and other engineering specialties in large quantities.

Many of the trained force of expert machinists, molders and other employees who were gathered together by the predecessors of the present executives are still there. Some of them have been there more than 30 years, two for 50 years. Nearly all of the employees who may be called veterans are stockholders in the parent company, an opportunity now open to all employees in both the parent and subsidiary companies.

The character of the product of this organization is so uncommonly precise and uniform that a representative of the United States Bureau of Standards is reported to have declared, after a careful inspection, that the Detroit Lubricator plant is one of the three manufacturing institutions of the United States which stands first with respect to precision standards of manufacturing.

Some micrometers and gauges are tested once a day, some two and three, and others are tested four times a day. One part of a radiator vent valve, for another example, is inspected under a magnification of 100 diameters.

The brass foundry now melts more than a carload of brass, on an average, every working day. Electric melting furnaces, electric cleaning machines which remove microscopic impurities from the re-melt, automatic cutters, and hundreds of machine tools, are included in the plant's equipment.

PRECISION MANUFACTURING METHODS IN THE ACCESSORIES DEPARTMENT

It is when visitors are taken to the Accessories Department, in the new six-story fire-proof factory, that they realize how extensively "precision manufacture" is serving another important field of usefulness, namely, radiator heating. Here are thousands of valves — packless, packed, Airid vent valves, Vac-Airid vacuum valves—an acre or so of valves. The new Vac-Airid, by the way, is now in quantity production after a year of successful testing.

It may strike most readers as a coincidence that the Detroit Lubricator Company and the former Detroit Radiator Company (one of the original constituent companies which merged to form the American Radiator Company), in their early days, were operated under the same roof. Each concern grew rapidly and required separate and larger plant space. Lubricator works now cover more than a large city block with six-story buildings on a portion. Thus it is natural that radiator valves and heating accessories should be among the earliest and most important products of the Detroit Lubricator. The acquisition of this company by the American Radiator Company is of comparatively recent date.

The two Airids have in common a thermostatic volatile element which causes the valve to close after the air is out of the steam radiator. To test the perfection of the metal drum and diaphragm action of this element, every valve is baked at controlled temperature for several days in an oven, and afterward put to the final tests. This baking is so severe a test that it discovers any minute defects that might escape the most rigid operating and visual tests during process of manufacture.

One of the most interesting sights in this big plant is the group of machines making a one-piece cylindrical bellows from a flat "pan-cake" of copper alloy. This bellows is in effect a vessel with "accordion-plaited" sides. It expands or contracts, when filled and sealed with volatile liquid, corresponding to changes of temperature. When placed rigidly in a control device it acts similarly with changes of pressure or vacuum. The bellows constitutes the motive power element of the varied types of "Mercoid control" and the Arco hot water regulator—familiar products of this young semi-centenarian.

With all other organizations of the American Radiator Company, this unit has had the co-operation of the Institute of Thermal Research, at Buffalo. Scientific tests of everything that has a possible bearing on improved heating, temperature or pressure control, are under way at all times.

Another evidence of the will to progress is that a division from the Buffalo general laboratories was recently moved to new quarters at the Detroit Lubricator Company, for even closer co-operation.

Eastern Manager for National Radiator Corporation

H. E. Tinker, formerly Philadelphia manager for the National Radiator Company, has been appointed eastern district manager for the National Radiator Corporation, of Johnstown, Pa., with headquarters in the City Center Building, Philadelphia. Wesley Barcus, formerly representative of the Niagara Radiator & Boiler Company, becomes Philadelphia manager of the National Radiator Corporation.

Columbia Radiator Takes Over Ironton-Bernhard Boiler Company

Columbia Radiator Co., McKeesport, Pa., has acquired all assets and equipment of the Ironton-Bernhard Boiler Co., Ironton, O., and will manufacture and distribute, in addition to its present complete line of McKeesport radiation and Columbia boilers, the entire line of Bernhard Triple-Combustion boilers. This places the Columbia Radiator Company in the field with a complete line of sectional boilers. J. B. Bernhard will be associated with the Columbia Radiator Company in a sales capacity.

National Association of Master Plumbers will hold its 46th annual convention in Memphis, Tenn., June 19-21, 1928. These dates were selected at a recent meeting, in Memphis, of the officers and directors.

American Society of Heating and Ventilating Engineers

Illinois Chapter Starts Endowment Fund for Research Laboratory

FIRED by the enthusiasm of Samuel R. Lewis, chairman of the Committee on Research, who was the principal speaker at the Illinois Chapter's annual meeting at the Hotel Sherman, Chicago, October 10, the chapter pledged itself to the inauguration of an endowment fund to place the laboratory on an independent basis.

In his address, Mr. Lewis declared that if every member of the society could go to the laboratory and see its work and scope, they would feel the same enthusiasm he did for its activities.

Mr. Lewis credited Past-President William H. Driscoll with inaugurating the co-operative research idea whereby several universities under the direction of the Research Laboratory are conducting investigations, the expenses of which are being shared by the laboratory and the universities. Mr. Lewis was of the opinion that this research will be more effective than if carried out exclusively at the laboratory, particularly on account of the better equipment and facilities possessed by most of the universities.

There was no difficulty, said Mr. Lewis, in securing subjects for investigation and for that reason the Subjects Committee has been abolished. The big job before the laboratory is that of securing money and brains. Among the institutions which are already co-operating with the laboratory in research work, or are about to do so, are: University of Wisconsin, University of Michigan, University of Kentucky, and the Carnegie Institute of Technology. He added that it is very likely additional co-operation will be secured from Harvard, Yale, and the University of Illinois.

Of particular interest was Mr. Lewis's statement that he anticipated the coining of a new term for a unit of heat. He spoke of the unit used by electrical engineers to designate watt as the third necessary factor in addition to the volt and ampere. He stated that the condensation and square footage figures to express the capacity of a radiator are not sufficiently certain. His suggestion was that the new unit be named a Kent. Mr. Lewis also referred to the code which has been developed by Professors G. L. Larson, of the University of Wisconsin, J. P. Kratz, of the University of Illinois, and J. C. Peebles, of the Armour Institute of Technology, for testing house insulating materials, and told of the surprise he felt when these professors submitted a complete code which since has been accepted by the National Association of Insulation Manufacturers.

Mr. Lewis told of a visit to Washington to learn more of a plan whereby dust-counting machines are to be loaned to all stations of the Weather Bureau throughout the country, so that simultaneous readings of dust collections will be made over a given period. He also expressed his gratification over the results of the weather-strip tests which have been conducted with the co-operation of the weather-strip manufacturers in the building of the Southwest Bell Telephone Company in St. Louis.

In referring to the financing of the Research Laboratory, Mr. Lewis stressed the need for an endowment fund which would increase in value from year to year and would furnish the laboratory with the money necessary for uninterrupted work. He then read a resolution adopted by the Board of Governors of the Illinois Chapter, at a meeting held the same day, to the effect that a 20-year endowment policy be taken on the life of the chapter president, the Laboratory Endowment Fund to be named as beneficiary. This statement was greeted with applause. Mr. Lewis said the action was a lead for other chapters to follow.

In the ensuing discussion John F. Hale suggested a building and loan investment, instead of a life insurance policy. Mr. Kehm stated that other organizations insured their principals and he was of the opinion that insurance would bring the most return. Harry M. Hart endorsed the endowment fund idea.

Mr. Lewis emphasized the fact that the objective was a permanent Research Laboratory, and he hoped that many wills in the future would include legacies for the endowment fund. Mr. Kehm suggested that the meeting authorize the Board of Governors to invest $300 a year in one of the three plans suggested; that is, insurance, building and loan, or savings accounts. This motion was carried.

Mr. Lewis expressed his gratitude. Mr. Hart thought that when the endowment fund becomes more widely known legacy contributions will be forthcoming.

This being the annual meeting of the chapter, new officers were elected as follows: President, E. P. Heckel; vice-president, J. Doherty; treasurer, August Kehm; secretary, H. G. Thomas. Board of Governors: A. B. Martin, T. H. Monaghan and J. H. O'Brien.

At the close of Mr. Lewis's address, President Heckel called upon Henry B. Gombers, secretary of the Heating and Piping Contractors National Association. Mr. Gombers said he just returned from Norfolk, Va., where the "certified heating" plan was adopted, and he told of the plans being made by Portland, Ore., to take on certified heat.

Returning to the endowment fund, Mr. Gombers stated that at a recent meeting of association secretaries, in West Baden, a plan was adopted whereby the secretary of the association was insured. If he remained in the service of the association until death his family was made the beneficiary, but if he retired the association was made the beneficiary.

Those elected to membership are Paul Abrahamson, Advance Heating Company; W. H. Moler, Carrier Engineering Company, and H. P. Reid, Universal Portland Cement Company.

New York Chapter Told of Research Laboratory Plans

Five past-presidents, including Samuel R. Lewis, chairman of the Committee of Research of the society, and F. C. Houghten, director of the society's Research Laboratory, were in attendance at the opening meeting of the New York Chapter, held October 17, at the Building Trades Club, New York. They were J. I. Lyle, S. R. Lewis, D. D. Kimball, William H. Driscoll and Walter S. Timmis.

In opening the meeting President Richard A. Wolff spoke of the loss the chapter had sustained in the death of Albert A. Cary. He also referred, in a gracious manner, to the presence of A. S. Armagnac, editor of THE HEATING AND VENTILATING MAGAZINE, following his long convalescence from the fall he had last winter.

Both Mr. Lewis and Mr. Houghten gave talks similar to those delivered the previous week at the meeting of the Illinois Chapter, dealing particularly with the work of the Research Laboratory and its plans for the immediate future.

Mr. Lewis told of the action of the Illinois Chapter in inaugurating an endowment fund for the Research Laboratory, and before the meeting was over a resolution was adopted by the New York Chapter referring the matter of the New York Chapter's participation in such a fund to the chapter's Board of Governors for report at a later meeting.

Opening Meeting of Michigan Chapter

Seventy members, "limited" chapter members and guests attended the opening meeting of the Michigan Chapter, October 17, at the Masonic Temple, Detroit. Following routine business, President Norman W. Calvert introduced J. R. McColl, past president of the society, as the speaker of the evening. Mr. Mc-

Coil emphasized the progress being made in the use of unit heaters, fin-type radiators, both for gravity and forced circulation, and the attractive new designs brought out by radiator manufacturing companies. He also referred to the interesting developments in connection with orifice control for both steam and water heating systems.

A. H. Betwee, of Warren Webster & Company, outlined the developments that had been made in the Donnelly system and told how, by orificing branch mains, risers and radiators, a better steam distribution is obtained. L. E. Allen spoke for the Grinnell hot water system and referred particularly to the company's Equiflo valve.

C. A. Dunham read a paper on the Dunham differential system, and was followed by J. S. Eilner, of the York Heating and Ventilating Corporation, who discussed unit heaters. Thomas Chester, of the American Blower Company, spoke for the fin-type of radiation.

The meeting followed the chapter dinner at which President Calvert started the ball rolling by calling for a personal introduction on the part of everyone present.

Minnesota Chapter Committees

Committees of the Minnesota Chapter which will function during the coming season are as follows:

Meetings Committee: E. F. Jones, chairman; D. Forfar, A. M. Wagner.

Membership Committee: J. H. Brown, chairman; S. H. Page, D. C. Ruff, E. J. Uhl.

Legislative Committee: S. A. Challman, chairman; E. B. Gordon, Charles Foster.

Nominating Committee: R. W. Otto, chairman; A. M. Wagner, A. L. Sanford.

Auditing Committee: A. W. Andresen, chairman; E. J. Burns.

Publications Committee: F. B. Rowley, chairman; Glenn Morgan.

New Committee on Standardization for H. & P. C. N. A.

The Committee on Standardization for the Heating and Piping Contractors National Association, as reorganized at the last meeting held at headquarters in New York, consists of the following: Ralph S. Franklin of Boston, chairman; William M. Hubbard of New York, Charles G. Lamb of Chicago, Robert C. Morgan of Philadelphia, W. R. Rhoton of Cleveland, and R. A. Wolff of New York.

The new members are William M. Hubbard, vice Walter L. Fleisher, resigned, and W. R. Rhoton, vice S. Austin Pope, resigned.

Important Papers Presented at St. Louis Fuels Meeting

NEARLY a thousand visiting engineers gathered in St. Louis, October 10-13, for the first national fuels meeting held by the Fuels Division of the American Society of Mechanical Engineers, with the cooperation of other national organizations.

The papers, by national authorities, dealt with almost every conceivable phase of fuel supply and utilization. Available supplies of natural fuels were discussed by O. P. Hood, chief, Technologic Branch, U. S. Bureau of Mines, who painted a pessimistic view of fuel reserves. He pointed out that the use of coal per capita had increased from 0.85 tons in 1870, to 5.15 tons in 1925, and that, notwithstanding the huge quantities now known to be underground, the cost of mining steadily is increasing, and very little remains to be mined at present costs. The speaker said that the natural-gas production in 1925 was approximately 8 cu. miles, representing an equivalent of 40,000,000 tons of coal, or less than a month's production of bituminous coal. The oil resources were placed at nine billion barrels, at the beginning of 1922.

A comprehensive paper entitled "Fuels, Past and Progressive," by Prof. S. W. Parr, dealt with the hand-in-hand increase in utilization of coal, the advance in efficiencies and the growing smoke evil. This paper provoked a lively discussion, mainly regarding the newer methods of utilization of raw fuels. It was the consensus of opinion that the complications introduced into some of the modern operations overweighed the benefits accruing, and that combustion of coal under boilers at the highest attainable efficiency represented perhaps the most advisable use of this fuel.

A classic paper on "Combustion and Heat Transfer," by Prof. R. T. Haslam and H. C. Hottel, of the Massachusetts Institute of Technology, was important largely for the reason that it presented accurate conceptions of phenomena that frequently are not understood by those vitally interested. Professor Haslam outlined recent developments in the theory of non-luminous gas radiation and formulated some new ideas on the subject of radiation from flame surfaces in powdered-coal furnaces.

Low temperature coal carbonization was well out of the experimental stage, according to Col. H. D. Savage, vice-president of the Combustion Engineering Corporation. He said that progress in this science had brought the necessary equipment to such a state that it could be handled by any ordinary boiler-room personnel. The lively discussion brought about by this paper indicated the general interest in the subject.

Henry Kreisinger, of the Combustion Engineering Corporation, spoke on "The Application of Powdered Coal to Small Boilers," and Prof. A. W. Gauger, of the University of North Dakota, told of the experiments in pulverizing and burning native lignites. "Characteristics of Modern Boilers" was the subject of a paper by E. R. Fish, vice-president of the Heine Boiler Company, dealing mainly with power boilers.

Progress in gas-producer applications was discussed by W. B. Chapman, vice-president of the Chapman Engineering Company. Prediction was made that gas-producers of large capacities would be used with boilers of special design, and English practice in this direction was cited.

Ernest H. Peabody, president of the Peabody Engineering Corporation, discussed the use of oil fuels for almost every phase of internal-combustion and furnace combustion practice.

Because of the presence of so many vitally interested engineers, the discussions were protracted and illuminating. The meeting was stimulating to all individuals and groups interested in the utilization of natural fuels, and undoubtedly will become an annual fixture.

Special Course in Heating Engineering at Purdue University

A short course in heating engineering has just been completed at Purdue University, Lafayette, Ind., sponsored by the Education Committee of the National District Heating Association, of which J. H. Walker, of the Detroit Edison Company, is chairman. The course was handled by Professors Hoffman and Hotchkiss, and consisted of lectures, study and problems on principles of heat losses from buildings, design of heating systems, properties of steam and steam tables. The course was intended to be basic in character and no attention was paid to operating phases of district heating. Employees of public utilities companies came from Michigan, Arkansas, Illinois, Ohio, New York and Indiana, to the number of twenty-four. The success of this course was so marked that it is intended to make it an annual affair.

IOWA POWER CONFERENCE, held March 30-31, 1927, under the auspices of the College of Engineering and the Extension Division of the University of Iowa, is reported in Extension Bulletin No. 170, published by the university at Iowa City, Ia. The subjects included a survey of the present power situation in Iowa, utilization of Iowa coal, and application of power to the development of the national resources of Iowa. Size 6 in. x 9 in. Pp. 155.

American Oil Burner Association

Oil Heating Institute to Have Budget of $250,000

A BUDGET of $250,000 for the Oil Heating Institute, for the season of 1928, was approved at the regular quarterly meeting of the directors of the American Oil Burner Association, held at the Ben Franklin Hotel, Philadelphia, October 11. Contributions to be based on net factory sales, as heretofore, with the provision that no manufacturer shall contribute less in 1928 than in 1927. A report of progress of the present campaign was made by Leod D. Becker, and this report will be forwarded to contributing members as soon as possible.

A resolution was adopted approving the proposed amendment to the constitution, enlarging the directorate to twenty-nine, permitting the two additional directors to be named from the associate division.

The adoption of a resolution authorizing the appointment of a committee, to co-operate with the National Electric light Association, was in line with the expressed desire of this association for detailed information regarding load characteristics and other features of oil burning of interest to central station managements. Lionel L. Jacobs appointed M. E. Simpson, chairman; W. C. McTarnahan, H. Finnie, C. U. Williams and Harry F. Tapp.

As a step in bringing into the association oil-burner dealers, the directors approved an amendment to the constitution that will permit local dealer associations to join the dealers' division as groups. When this procedure is ratified, it is proposed to carry on this campaign through a field organizer, first enlisting known strong local groups and extending the enlistment to individual dealers. In this way it is proposed to bring into active and useful membership every individual interested in oil burning or in correlated activities.

Details relating to the next annual convention were discussed and several important rulings made. The registration fee will be 50 cents, and members will be entitled to 10 free registration tickets. Exhibitors will be entitled to 15 additional tickets, gratis. The exhibit hall will be open only between 8 A.M. and 1 P.M., and from 5 P.M. to 7 P.M. each day except on the last day, when the hall will be open until midnight.

Acting on a recommendation of a Special Committee on Relations with the Underwriters' Laboratories, headed by L. H. Van Ness, Edward C. Bailey was appointed as the association's representative on the Flammable Liquids Committee of the National Fire Prevention Association, to secure certain changes in the existing fuel-oil rules which are prepared by the N.F.P.A. and endorsed and issued by the National Board of Fire Underwriters, and hence are the basis of most of the local ordinances on oil-heating installations. The committee was particularly requested to secure modification in the provisions governing inside basement storage, to enlarge the storage permitted to 550 gal. At a later meeting of the Flammable Liquids Committee, held at association headquarters, October 14, it was learned from the chairman that the committee has recommended a complete revision of the present fuel oil rules. Steps will be taken by this committee to draft a new set of rules which will be submitted to the entire membership of the association before they are forwarded to the Flammable Liquids Committee.

A resolution was adopted providing that the managing director designate a man on the association staff to provide the information necessary to take care of proposed State and municipal legislation affecting the installation of oil-heating equipment.

A resolution also was adopted authorizing the managing director again to undertake to secure a monthly manufacturers' census. The consensus of opinion was that all manufacturers should furnish individual figures, these figures to be released only in total, and individual replies to be considered strictly confidential. It was pointed out that data would be of particular value during the current year or for any other similar period.

The question of proper standards and censorship on advertising claims for oil heaters was referred to the Committee of General Trade Practices.

The next quarterly meeting of the Board of Directors will be held at the Hotel Stevens, Chicago, January 10.

Chicago Oil Burner Association

Joseph F. McGrail, M. A., of the A. W. Shaw Company, was the speaker at the October meeting of the Chicago Oil Burner Association, held October 11, at the Allerton Club, Chicago. His subject was "The Knack of Selling."

Plans were announced at the meeting to hold a stag dinner before the next regular meeting, and J. W. Owens, Cliff W. Presdee and G. C. Sutton, were named a committee to make the necessary arrangements.

The Ordinance Committee reported progress in the work of securing more equitable ordinance regulations and fees.

Class Magazines Feature Oil Heating

Reflecting the public interest in the use of oil fuels for house heating, many of the national magazines are publishing articles on this subject. *House & Garden*, for September, presented a story "Advancements in Oil Heating" by Ethel R. Peyser. *Arts and Decoration* for the same month contained an article by C. Stanley Taylor. *Your Home*, in an article entitled "The Heart of the Home is the Heating Plant," featured the use of oil as fuel. *Florists' Exchange & Horticultural Trade World* recently devoted considerable space to an article on oil heating for greenhouses.

Smithsonian Institution Planning Permanent Steam Power-Plant Engineering Exhibit

Plans have been inaugurated by the Smithsonian Institution, in Washington, D. C., to establish an American Industrial Museum, devoted to the history, development and present problems of steam power plant engineering. The Divisions of Mineral and Mechanical Technology will proceed with the development of a single unit of such a museum in accordance with the best modern museum practice. When completed, this unit will function as though it were really a part of a complete engineering museum. Steam power plant engineering was selected as the subject to be treated in the demonstration unit.

It is planned to treat the subject in two parts: one, its history, and the other, modern practice. Approximately 3000 sq. ft. of floor space will be devoted to the exhibit which will include a series of models of early engines, together with modern fuel and ash-handling equipment, turbine rooms, condensers, boilers and draft apparatus.

Chicago Oil Burner Association, at its regular monthly meeting at the Allerton Club, September 13, was addressed by B. K. Eaton, of the Winslow Boiler and Engineering Company, whose subject was "Selling in the Oil-Burner Industry." He discussed the proper methods available to secure increased sales volume. The meeting stood for one minute in silence as a mark of regret to the passing of Ross Flowers. The Century Engineering Corporation, Charles I. Goodhart, was unanimously elected to membership.

Power Show to Exceed All Records

NO less than 500 exhibitors, with displays of boilers, stokers, furnaces, superheaters, valves and other equipment essential to the economical generation of steam, will be represented at the forthcoming Sixth Annual Exposition of Power and Mechanical Engineering, better known as the Power Show, which goes on at the Grand Central Palace, New York, December 5-10. A prominent place will be given to displays of heating and ventilating equipment, refrigerating machinery, instruments for measuring and recording time, pressure, volume, temperature, gas and air flow. The exposition has been termed a complete mechanical show.

In scope, size and volume of exhibits, attendance and influence on the industry, the power show no doubt will be an important factor in the development of mechanical engineering. Over 100,000 people visited the show in 1926. Compared with the first show in 1922, this represents an increase of 80,000 attendants, while the number of exhibits have increased three-fold and more.

In the planning and conduct of the exposition, the management is aided by an Advisory Committee consisting of I. E. Moultrop, chairman, Edison Electric Illuminating Co., Boston; Homer Addams, past president, A.S.H. & V.E.; F. Paul Anderson, president, A.S.H. & V.E.; N. A. Carle, vice-president and general manager, Public Service Production Co.; Willis H. Carrier, president, A.S.R.E.; Fred Felderman, past national president, N.A.S.E.; C. F. Hirshfeld, chief, research department, Detroit Edison Co.; O. P. Hood, chief mechanical engineer, U. S. Bureau of Mines; John A. Hunter, chairman, power division, A.S.M.E.; E. B. Katte, chief engineer electric traction, N.Y.C.R.R.; R. T. Kent, chairman, Professional Divisions Committee, A.S.M.E.; John H. Lawrence, Thomas E. Murray, Inc.; Fred R. Low, past president, A.S.M.E.; David Moffat Myers, consulting engineer; R. F. Pack, president, N.E.L.A.; Calvin W. Rice, secretary, A.S.M.E.; Charles M. Schwab, president, A.S.M.E. The managers of the exposition are Fred W. Payne and Charles F. Roth.

The heating and ventilating industry will be represented by the following exhibitors:

Exhibitors

Absolute Con-Tac-Tor Corporation
Aerofin Corporation
Alexander Brothers
American Blower Company
American Brass Company
American Pipe Bending Machine Co.
American Schaeffer & Budenberg Corp.
Armstrong Cork & Insulation Company
Armstrong Machine Works
Atlas Valve Company
Atwood & Morrill Company
Badger & Sons Company, E. B.
Bailey Meter Company
Barnes & Jones
Bethlehem Shipbuilding Company
Bridgeport Brass Company
Bristol Company
Brown Instrument Company
Buffalo Forge Company
Buffalo Steam Pump Company
Bundy Steam Trap Company
Burhorn Company, Edwin
Byers Company, A. M.
Cameron Steam Pump Works, A. S.
Carrick Engineering Company
Carrier Engineering Corporation
Cash Company, A. W.
Celite Products Company
Century Electric Company
Chapman Valve Mfg. Company
Chicago Chemical Company
Chicago Pump Company
Clarage Fan Company
Cochrane Corporation
Combustion Service Corporation
Connery & Company, Inc.
Continental Valve & Mfg. Company
Cork Foundation Company, Inc.
Crane Company
Crosby Steam Gauge & Valve Company
Cutler-Hammer Mfg. Company
Davis Engineering Corporation
Davis Regulator Company, G. M.
DeBothezat Impeller Company
d'Este Company, Julian
Dunham Company, C. A.
Economy Pumping Machinery Company
Fairbanks, Morse & Company
Farnsworth Company
Federal Gauge Company
Fisher Governor Company
Foster Engineering Company
Foster-Wheeler Corporation
Foxboro Company, Inc.
Frank Heater & Engineering Company, O. E.
Fulton Sylphon Company
Garden City Fan Company
General Electric Company
Gillis & Geoghegan, Inc.
Grinnell Company
Griscom-Russell Company
Hardinge Company
Hays Corporation
Heating & Ventilating Magazine Co.
Hill Company, E. Vernon
Hoffman Specialty Company, Inc.
Homestead Valve Mfg. Company
Ilg Electric Ventilating Company
Illinois Engineering Company
Insulating Products Corporation
Iron Fireman Automatic Stoker Corp.
Jenkins Brothers
Johns-Manville, Inc.
Johnson Service Company
Keating Pipe Bending & Supply Co., E. F.
Keeler Company, E.
Kieley & Mueller, Inc.
Korfund Company, Inc.
Lincoln Electric Company
Linde Air Products Company
Liquidometer Company, Inc.
Locke Regulator Company
Mason Regulator Company
Metal Stamping Company
Midwest Piping and Supply Company
Modine Mfg. Company
Nash Engineering Company
National Regulator Company
National Tube Company
Nelson Corporation, Herman
Northern Equipment Company
Oxweld Acetylene Company
Peerless Unit Ventilation Company, Inc.
Permutit Company
Pittsburgh Piping and Equipment Co.
Powell Company, William
Powers Regulator Company
Pratt & Cady Company
Preferred Utilities Mfg. Corporation, Inc.
Pyramid Iron Products Corporation
Quigley Furnace Specia'ty Company
Ray Mfg. Company, W. S.
Reading Iron Company
Reed Air Filter Company
Reliance Electric & Engineering Co.
Reliance Gauge Column Company
Republic Flow Meters Company
Rome Brass Radiator Corporation
Ross Heater & Mfg. Company
Ruggles-Coles Engineering Company
Ruggles Klingemann Mfg. Company
Sarco Company, Inc.
Schutte & Koerting Company
Shaw Company, Benjamin F.
Simmons Company, John
Skidmore Corporation
Spencer Turbine Company
Sturtevant Company, B. F.
Swartwout Company
Sweet & Doyle Foundry & Machine Co.
Sword-Silent Oil Burner Corporation
Tagliabue Mfg. Company, C. J.
Taylor Instrument Companies
Toledo Pipe Threading Machine Co.
Uehling Instrument Company
Vinco Company, Inc.
Vulcan Radiator Company
Vulcan Soot Cleaner Company
Walworth Company
Warren Webster & Company
Watts Regulator Company
Westinghouse Electric & Mfg. Company
Wing Mfg. Company, L. J.
Worthington Pump & Machinery Co.
Wright-Austin Company
Young Pump Company
"X" Laboratories

Next month's issue will contain the booth numbers and other particulars of the heating and ventilating exhibitors for the convenience of those attending the show.

Bureau of Standards Reorganized

An important change in the administrative organization of the Bureau of Standards, designed to increase its efficiency through a better grouping of the bureau's numerous activities, is the appointment of Dr. L. J. Briggs as assistant director in charge of research and testing, and of Ray M. Hudson as assistant director in charge of commercial standards. Activities under the immediate supervision of Doctor Briggs would include all the bureau's scientific research and testing, and the development of reference and working standards, while Mr. Hudson will supervise the formulation of commercial standards, including activities of the Simplified Practice Division and part of the work of the division of building and housing relating to codes and standards.

Doctor Briggs will act as executive head of the bureau in the absence of Director George K. Burgess.

Mercoids Features Forecast of Oil-Burner Development

By P. E. Fansler

THE "oil burner" of the future will not be a burner at all, according to the feature article in the October issue of Mercoids, the house organ of the Federal Gauge Company. This story, prepared by the associate editor of THE HEATING AND VENTILATING MAGAZINE, at the request of L. H. VanNess, president of the Federal Gauge Company, expresses the personal views of an engineer with a background of fifteen years of experience in gasoline and oil combustion, who has close contact with research work now in progress. The thoughts presented may seem revolutionary, but the facts behind them cannot be controverted.

LOOKING backward upon the growth and development of any industry furnishes first-class entertainment to anyone who enjoys retrospective analysis; there always is a fascination in tracing the steps by which human achievement has mounted higher and higher in any particular field of endeavor, be it scientific, engineering, medical or industrial.

Looking forward, endeavoring to pierce the veil of future development, is vastly more seductive and, at the same time, infinitely more dangerous. At the risk of gaining a reputation as a lesser prophet, I am going to venture some thoughts concerning the future of the oil-burner industry. No man can attach to any such prognostication any valid data in substantiation of his theories; time and yet more time will discredit or prove the correctness of his prophecy.

The restlessness of the present age extends into every fibre of our life and development. We are not content to let well enough alone. Our homes may be built to very satisfactory standards; refrigerating and heating equipment for these homes may be worked out to a high degree of satisfaction and efficiency; radio receiving sets bring in broadcast programs with marvelous fidelity of tone and timbre; transportation by rail has reached a point of luxury and speed that seems to fill every legitimate want; photography has progressed, within the span of my own interest, from a point where the cartridge film first was available, with daylight loading feature, to the present, when I record the activities of my children upon the "movie" film with less thought of the marvels of the science than I gave to the old early-model kodak.

In every phase of our national life, however, progress is working overtime. Home insulation, practically unheard of a few years ago before long will become universal and commonplace; refrigeration of food in our homes, coupled with an increased appreciation of the capabilities of the little fractional horsepower motors, undoubtedly will lead to unit air-conditioning plants suitable for the average home; the radio transmission of pictures now being played with by amateurs shortly will give way to television, with the sky as the limit; passenger transportation by rail, for many routes, will be supplanted by air travel, as certainly as the horse has given way to the automobile.

A great many of us in the heating and allied industries are keenly interested in the epoch into which only recently we have entered—the heating of homes with fluid fuels, more particularly oil.

It indeed would be unfortunate if we were to obscure our vision, in contemplating the possibilities in this field of endeavor, by a blind acceptance of present equipment as the ultimate, either in type or general method of functioning. I shall hazard a prediction that, in ten years, with a little leeway, the oil burner as we know it to-day will not exist. And here is my line of reasoning:

IN the extraordinary advance of the oil-burner field during the last few years, Mr. Fansler has become nationally known for his vigorous championship of all conscientious efforts to stabilize the industry. He is best known as a writer on the technical phases of oil-combustion in which he stands for accuracy in knowledge and expression. He is the author of "House Heating With Oil Fuel"—the "bible" of the industry.

Mr. Fansler was graduated from Purdue University in 1901, in 1903 received the degree of electrical engineer, the highest bestowed by the university, and has had exceptionally broad engineering experience. He conceived and started the first commercial air-line in the world, two years before the initial European attempt, and during the war, due to his aeronautical experience, was in charge of aviation engine inspection and production in the eastern district for the Bureau of Aircraft Production. He also has had extensive experience in internal combustion engineering.

Every oil burner in operation to-day accomplishes two interlocking functions; liquid hydrocarbons are converted into gaseous hydrocarbons (which, chemically considered, are elementary fuels) and the combustion of these gases is provided for. One point, however, must be emphasized—these gases depend upon heat for their existence, and, unless maintained above definite temperatures, revert to liquid form. *They are unstable gases.*

Combustion is accomplished with varying degrees of efficiency nearly always in furnaces or boilers not designed for oil firing. The results, while highly satisfactory to the average citizen of the day, are below the possible optimum; they leave much for which to strive.

Consider, now, the gas-fired boiler and furnace. It is specifically designed for this fuel, and its efficiency possibilities are admittedly far greater than those of the average coal-fired unit. Stack temperatures in gas-fired installations are much lower than in those fired with oil. Yet the low limit of stack temperature is not predicated upon boiler design, but upon the propensity of the gas, rich in hydrogen, to produce water as an important end-product of combustion. This makes it necessary to provide non-corrosive smoke pipe and deliberately to increase the stack temperature above its possible minimum in order to keep the chimney reasonably dry.

Suppose, now, that we conceive of a home having, in its cellar, or buried in the ground, a machine that will make, from our common oil fuels, *a stable gas*, in quantities and at times wanted. The machine might be of the instantaneous type, making gas exactly as required, or it might incorporate a small storage, maintaining this reserve always at a definite minimum.

This stable gas then can be piped into and through the home, supplying heat from combustion taking place in a specially-designed heating plant that conceivably might show an over-all efficiency of 90%, even in small units. Gas from the same source would supply the kitchen stove, the domestic water heater, the refrigerating unit, the air-conditioning plant and the newer items of home equipment that are, as yet, undeveloped. Duplication of the essentials in the gas plant will insure continuity of service under all conditions except lack of oil.

This is an evolutionary picture, fraught with fascination for all engaged

in any part of the oil-burner industry, and in those contributory fields from which so much of vital importance is drawn.

The focal point of such an all-service plant for the home will be its controls. As a matter of fact the essence of all utilization of nature's forces or resources is in the complete and certain control that can be attained. Heat, electricity, hydraulic and wind power—all become the servants of man by virtue of *definite control* over them.

If things come to pass along the lines of this prediction—and I personally know of material advances in technique that make such equipment possible—it will be found that the engineering skill responsible for the marvelous control equipment of the present day will not be found wanting in providing controls possessing the requisite qualities of sensitiveness and ruggedness to take command of our unified home utilities.

Hoffman Dinner for Detroit Heating Trade

WHAT is described as the greatest meeting of the heating trade ever held in Detroit, took place September 30, in the General Motors Building, when 800 men identified with the industry in Detroit assembled as the guests of the Hoffman Specialty Company. This event inaugurated the company's annual sales campaign in the Detroit territory.

Following a five-course dinner, served by Chef Adriani of the General Motors, the meeting was called to order by William Boales, Detroit manager of the Hoffman Specialty Company. Mr. Boales thanked William G. Miller, president of the Detroit Association of Sanitary and Heating Contractors, Bruce Wigle, publicity committee chairman of the association, and Thomas F. Carson, executive secretary of the association, for their co-operation in helping to make the meeting a success.

At Mr. Boales' request President Miller spoke for the association, extending a word of welcome. Mr. Boales then introduced Charles V. Haynes, vice-president and general sales manager of the Hoffman Specialty Company, who told of the 14 years of steady and consistent growth of the company. He made the announcement that Mr. Boales had been appointed zone supervisor for the Hoffman Specialty Company for Ohio, Michigan, Kentucky, West Virginia and Indiana, and that this was the result of strict adherence to duty.

Mr. Boales then introduced Guy Hutchinson, vice-president and general manager of the company, who told of the fallacy of price cutting, characterizing it as a childish method of obtaining business. He spoke of the intense competition of to-day but termed it "the new competition," the battle of all industries to receive their portion of the American dollar and that it should not be interpreted as competition within the industry as that is not the competition that is so injurious. In order to offset new competitors, those in the industry must sell more goods than ever before. He suggested that we take a reef in our sails and get down to the real fundamentals of selling. He pointed out that the Hoffman Specialty Company has spent over a million dollars in the last five years in advertising, which has paid and paid well, and that the company is continuing this advertising program both locally and nationally in order that its product and dealers may be backed up by an intelligent appeal to the buying public. As food for thought he pointed out that there are 24,000,000 homes in the United States, 17,000,000 of which have no steam heat.

Mr. Boales introduced Frank Gaylord, zone supervisor of the company, whose territory comprises an area stretching from Chicago to Denver, and from Duluth to Texas. Mr. Gaylord spoke of the history of steam heat and pointed out the fact that Mr. Hoffman, founder of the Hoffman Specialty Company, was a pioneer in the perfection of steam heat because of the development of the Hoffman air valve. Further research on the part of Mr. Hoffman and his associates has resulted in the company's present extensive line.

After dinner a recess of fifteen minutes was taken to rearrange the banquet room for the presentation of a moving picture entitled "The Heat Thief," starring Ann Pennington, Follies star. This motion picture is unusual because it actually portrays the battle between steam and air. It clearly shows the necessity for the proper venting of a steam system in order that any accumulated air in the pipes and radiators may speedily be thrown off without taking in additional air. It is novel also in that it is the first commercial movie of its kind actually going into the details of the product and yet incorporating a well-defined plot.

After the showing of "The Heat Thief," Mr. Gaylord, by the aid of charts, pointed out the more salient features of the Hoffman valve.

During the past month similar dinners and meetings were held by the Hoffman Specialty Company in San Francisco, Chicago, New York, Boston, Cincinnati, and Baltimore. Minneapolis and St. Paul held a joint dinner.

Nokol News for October features the consolidation of the Nokol and Aetna oil-burner organizations as announced in THE HEATING AND VENTILATING MAGAZINE for October. The leading story tells, in a graphic way, of the genesis and development of these well-known burners to the point where a merger became advantageous to both manufacturers. Another article is a comprehensive description of the Aetna burner, while a third features an Aetna installation in a large worsted mill in Woonsocket, R. I.

Hoffman Specialty Company's Dinner in Detroit

Present Practice in Vapor Heating

Previous articles in this series are:

1. *Webster Type R Modulation System, August*, 1926.
2. *Dunham Home Heating System, August*, 1926.
3. *The Illinois System, September*, 1926.
4. *Hoffman Controlled Heat, September*, 1926.
5. *The Mouat System, October*, 1926.
6. *The Trane System, November*, 1926.
7. *The Sarco System, December*, 1926.
8. *The O-E Perfect 3-in-1 System, January*, 1927.
9. *The Gorton System, February*, 1927.
10. *The Barclay System, May*, 1927.
11. *The Richardson System, June*, 1927.
12. *The Barnes & Jones System, July*, 1927.

13. The Broomell System

ESSENTIALS of modern vapor heating may be classified as comfort, elasticity and economy. These essentials are provided by that system which (1) delivers the requisite amount of heat to every room, this heat being produced and delivered at the minimum of expense, (2) provides for the regulation of the temperature at the radiators without opening or closing windows or going to the basement to check or stimulate the fire, instantly increasing or decreasing the heat obtained—all with the minimum of effort, care and annoyance and with a minimum expense for repairs and overhauling.

This is the ideal which the Vapor Heating Co., 201 North George St., York, Pa., has set up in the manufacture of the Broomell system of vapor heating. The Broomell system, by the way, is known as the original vapor heating system.

GENERAL PLAN OF PIPING

The shape and size of the building, to a very great extent controls the location of boiler and the system of piping to be employed—whether the supply and return piping should be run around sides and ends of building in a complete circuit or whether they should be run through the center or along the one side of building, as illustrated in Fig. 1. However, the general plan of piping obtains in every installation, that of taking one or two mains off a header on the boiler, pitching them away from the boiler and bleeding ends and all low points through a wet return run along the floor and connecting to the boiler below the water-line. From these mains the radiator supply risers are taken from the top or at an angle of 45 degrees. The air and condensation return mains are pitched toward the boiler, the ends of these mains connecting to the air eliminator compartment of the Broomell receiver, all low points of the return main being bled into the wet return. From these return mains the radiator return risers are taken from the top or at an angle of 45 degrees.

From the steam space of the boiler or from the steam header, an equalizer pipe is run into the bottom of the boiler below the water-line. From the steam space of the boiler a pipe is connected to the safety valve compartment of the receiver. From the bottom of the receiver and from the bottom portion of safety valve compartment of receiver, as illustrated in Fig. 3, pipes are connected to the bottom of boiler below the water-line. There are no check and no air valves in the lines. The only valves in the basement are in the boiler cold-water supply line and in the line from boiler to sewer.

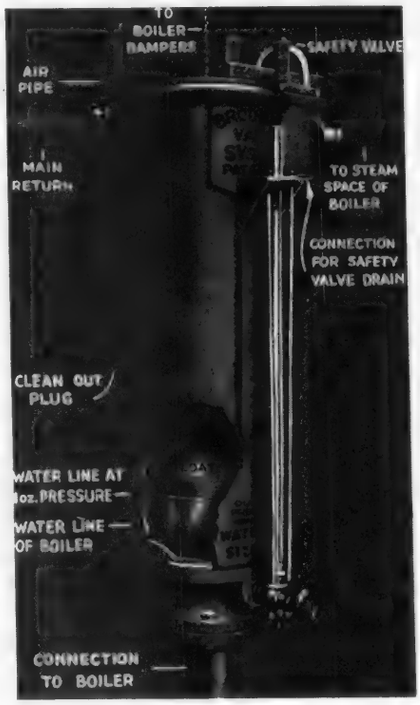


Fig. 2. Combined Condensate Receiver, Air Exhauster, Pressure and Water Gauge, Damper Regulator and Safety Valve

Any good steam boiler may be used with the Broomell system—the only requirement being that it must be guaran-

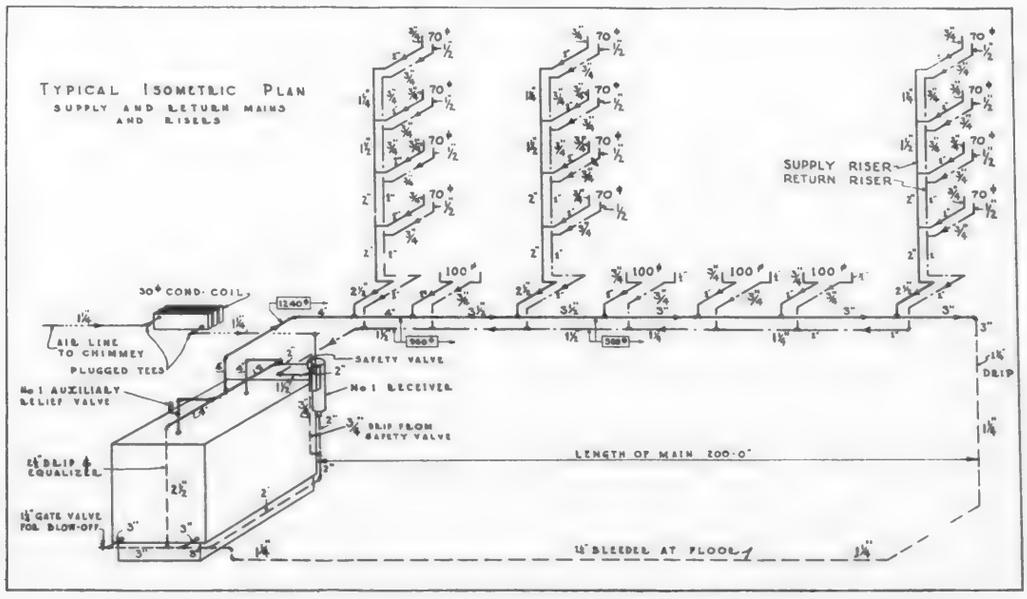


Fig. 1. Typical Isometric Plan of Broomell System

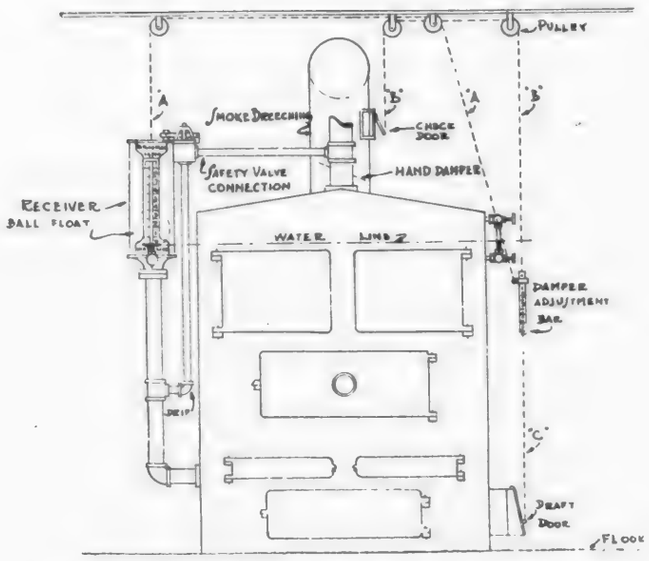


Fig. 3. Typical Connection for Damper Control

teed by the manufacturer to have a capacity, with proper fuel and management, to supply steam at a pressure of 6 oz. at the boiler in zero weather for the radiating surface required by the building to be heated.

From the joists on ceiling of basement, above or in close proximity to the receiver, a small water-type indirect, wall or flat coil-type radiator is placed. A pipe is run from the air exhauster compartment of receiver to one end of this coil and from the opposite end of coil a pipe is run to the chimney. When a radiator valve is opened, the draft of the chimney pulls the air from the radiators, causing the vapor immediately to follow and fill the radiator. Any vapor passing the return elbow seal on the radiator, due to excessive pressure or volume, immediately is condensed by this coil and returned to the receiver in the form of condensation. When thermo traps are used on radiators, instead of elbow seals, no condensing coil is required.

Standard water-type radiators are used with the Broomell system. They are tapped either ¾ in. or 1 in. at one end of the top, depending upon the size of the radiator, for the Broomell modulating valve, and tapped ½ in. at the bottom opposite end for the Broomell return elbow seal.

THE RECEIVER THE HEART OF THE SYSTEM

In the Broomell system, this foolproof automatic device, known as the Broomell receiver, is the heart of the system. Placed on the side of and connected to the boiler, it forms and constitutes a combined condensate receiver, air exhauster, pressure and water gauge, damper regulator and safety valve. It is illustrated in Fig. 2 and, in Fig. 3, is shown attached to the boiler. To it flows the condensation from the radiators. Through it the air is pulled from the radiators. On it the pressure of the vapor and the height of the water in the boiler are registered. By it the pressure of the vapor is regulated and the fire checked and stimulated to meet the demands of the radiators above. It is designed to prevent the pressure from getting near the danger point, as the safety valve portion of the receiver will relieve the boiler of undue pressure in the event of the ash-pit door being left open through accident or neglect, and, in the case of oil-burner, gas-burner

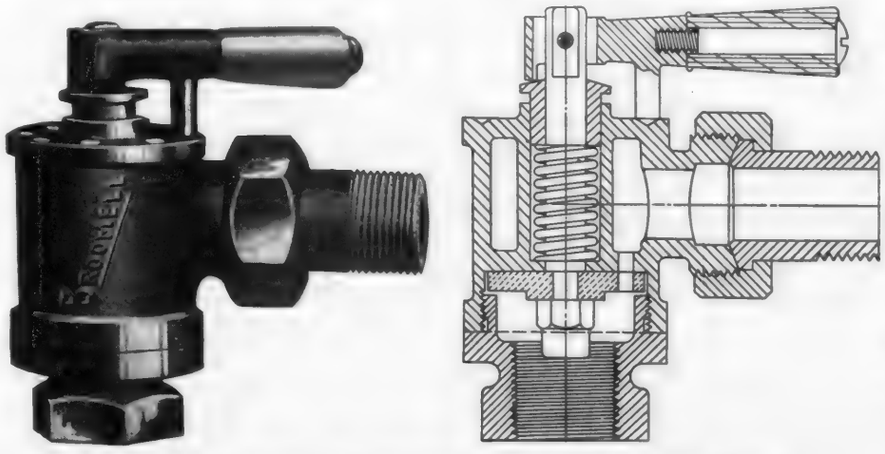


Fig. 4. Exterior and Sectional Views of Modulating Valve

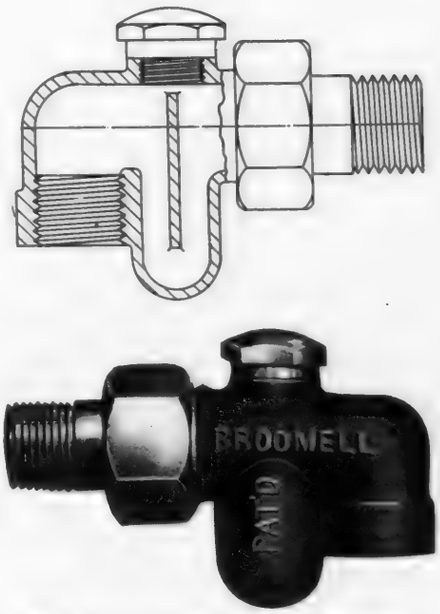


Fig. 5. Cross Section and Exterior Views of Elbow Seal

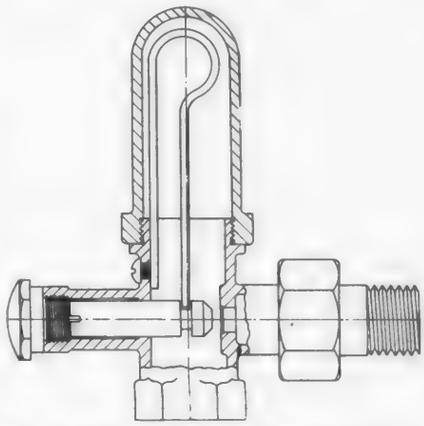


Fig. 6. Sectional View of Thermo Trap

pressure or temperature controls, failing to function.

Broomell modulating valves, illustrated in Fig. 4, are placed at the supply end of radiators at the top to obviate stooping and with them the control of room temperature and the boiler fire may be maintained at the radiators. As the temperature of the room is lowered, opening the modulating valves, the fire is stimulated, causing the vapor to flow quickly and steadily in the radiators. As the temperature rises in the rooms by partly or wholly closing the modulating valves, the fire is checked, thereby diminishing, or entirely stopping, the flow of vapor to the radiators.

The Broomell seal, illustrated in Fig. 5, is placed at the one end of the radiator at the bottom and permits the condensation to be discharged freely from the radiators, while the air is exhausted from the radiators through a small orifice above the water-seal. An air-bound radiator simply cannot be heated, regardless of the pressure, nor can it be noiseless under such conditions. In the Broomell system, the air is not removed by the pushing force of the vapor behind it, but it is pulled from the radi-

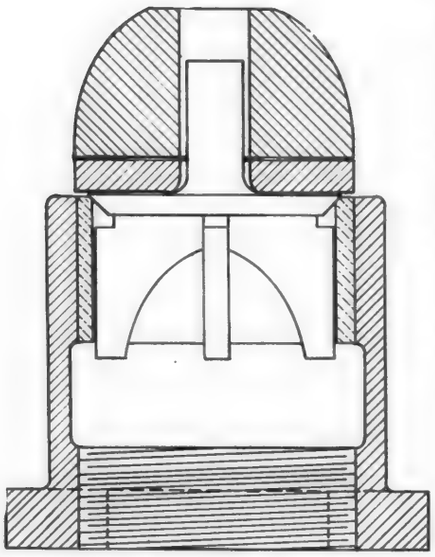


Fig. 7. Cross Section View of Pressure Relief Valve

ators through the medium of the seal, receiver and condensing coil, despite variations in boiler pressure. This suction has the effect of preventing air-bound radiators unless traps are formed in laterals through faulty construction or settling of the building.

A Broomell thermo trap, illustrated in Fig. 6, is used on the return end of direct radiators, especially on radiators of the lower floors of tall buildings, on indirect radiators, on fan heating coils, on garage radiators, etc., to suit existing conditions.

In addition to the safety valve on the receiver, the Broomell pressure-relief valve, illustrated in Fig. 7, is placed directly on the steam space of boiler or on a supply pipe line, close to boiler. This is a further provision to prevent excessive accumulation of vapor in the boiler, in the event of the ash-pit door having been left open through accident or neglect, thus nullifying the automatic control of the draft furnished by the receiver, and also in the case of oil-burner or gas-burner pressure or temperature controls failing to function.

General Air Filters in Cincinnati Masonic Temple

In THE HEATING AND VENTILATING MAGAZINE for September, Page 110, appeared an article describing the automatic air filters that had been installed in the Masonic Temple, Cincinnati, by General Air Filters Corp., New York. While these filters are automatically cleaned by flooding with a viscous oil, attention was drawn to the fact that the construction permitted easy removal of the elements for hand cleaning, if this ever should be found necessary. The phraseology used might be construed to indicate that doubt existed as to the efficacy of the automatic cleaning, whereas several years' experience in operation has indicated that these filters are thoroughly cleaned by the automatic method. The filter is so constructed, that if, for any reason such as abnormal or extraordinary operating conditions, it is desired to clean them by any method other than the normal method arranged for by the manufacturer, the filter cells are easily removed and replaced for this purpose. This type of construction also permits of great flexibility, allowing the installation of the units in cramped or irregularly shaped quarters. The illustration showed a battery of six of these filters installed in the Cincinnati Masonic Temple, and not in Cleveland as stated in the caption.

W. B. Wilde Company Reorganized

Coming out of the far West to assume the presidency and general management of the Preferred Oil Burners, Inc., Peoria, Ill., A. E. MacInnis, of Seattle, Wash., brings with him a reputation as an executive that augurs well for this company. Preferred Oil Burners, Inc., has been formed to take over the W. B. Wilde Co., Peoria, manufacturer of the Hart oil burner and the Preferred Utilities Corp., New York, manufacturer of oil burning accessories. Associated with Mr. MacInnis are Richard S. Bohn, president of the Preferred Utilities Corp., New York, and Spencer A. Merrell, president of Merrell & Co., St. Louis, as vice-presidents, L. V. Tefft, patent attorney of Peoria, will be secretary, and J. Paul Schnellbacher, former vice-president will be treasurer. Gerald W. Bohn, of the Preferred Utilities Corporation, and R. S. Whaley, of the Power Plant Engineering Co., Seattle, are financially interested.

The new blood injected into the Wilde company stands for some of the best known and most aggressive individuals in the oil-burner industry. Mr. MacInnis is president of the Power Plant Engineering Co., Seattle, leading oil-burner distributors of the northwest. This organization has more than 100 employees in Seattle, Portland and Tacoma, and has 50 dealers. During the past season the volume of business transacted by this company exceeded a million dollars.

It was Mr. MacInnis who established the fact that oil burners could be sold during the early months of the year in great volume. In April, 1926, the organization of the Power Plant Engineering Company sold 369 installations in 30 days. During the same 30-day period, this year, their sales totaled 614 installations. Mr. MacInnis is of the opinion that his sales during 1928 will be considerably in excess of the 1927 record because of the new line of Hart burners.

Richard S. Bohn is a director of the American Oil Burner Association, and as one of the largest oil-burner distributors in the country, with more than eighty dealers in its eastern organization throughout New York State and New England, he will purchase equipment from the Peoria factory. Mr. Bohn will remain in active charge of his eastern interests.

Spencer A. Merrell is a salesman and organizer of nationally known ability. One of his feats was to set a sales record for an individual by selling 49 oil burners in one month, single-handed. His organization has long held a distributor's franchise for southern Illinois and eastern Missouri.

L. I. Aldrich, who has been chief engineer of the Hart factory for a number of years, will remain in active charge of the experimental engineering department of the factory.

American Radiator Company Acquires Kewanee Boiler Company

Subject to the approval of the stockholders of the Kewanee Boiler Company, of Kewanee, Ill., the entire property of that company has been purchased by the American Radiator Company. The present Kewanee Boiler Company will be liquidated, following which a new company of the same name will be organized to continue the business. The officers of the present Kewanee Boiler Company will be continued so that the management of the new company will continue in the same hands.

One of the immediate features of the expansion program is a plan for the expenditure of $200,000 for additions to the plant in Kewanee to manufacture a new steel heating boiler which has been designed by the Kewanee Boiler Company.

Opportunity will be given to each stockholder to exchange his holdings in the Kewanee Boiler Company for stock in the American Radiator Company.

In acquiring the properties of the Kewanee Boiler Company, according to President E. E. Baker, the American Radiator Company will be in a position to offer its customers a line of steel boilers which it has not been able to do up to the present.

Assets of the Kewanee Boiler Company as of December 31, 1926, were $5,212,557. The company has preferred stock to the amount $974,900 and common stock to the amount of $2,599,700. There is no bonded debt. The company's surplus is $1,197,920.

During the World War the Kewanee Boiler Company established a record of accomplishment by the fabrication and prompt delivery of 19,410 boilers, heaters and tanks for government use.

Oil Burners for Large Low-Pressure Heating Plants

Ray. *Mechanical Atomizing, High-Low or Intermittent Operation*

Previous articles in this series are:
1. *Todd*, August, 1927.
2. *W. N. Best*, September, 1927.
3. *Ballard*, October, 1927.

4. Ray

W. S. RAY MFG. CO., San Francisco, was established in 1872, and, for many years, produced oil burners and oil-burning ranges. In 1915, W. R. Ray was granted the first of many patents covering the horizontal-rotary oil burner, and this unit was the beginning of what now are the Ray fuel oil-burning systems. The manufacturer has distributors and representatives in practically every large city in the world.

Ray burners are built for continuous operation, between high and low limits, and for intermittent, all-off or all-on, service. They also may be grouped into two classes, depending upon whether the oil pump is an integral part of the burner unit, or a separate element, installed at a distance from the boiler front. Either class can be used for firing high-pressure or low-pressure boilers.

The non-pump-type burner consists of an electric motor rotor, or armature, mounted on a hollow shaft, together with a blower and atomizing cup. This rotating unit is carried on annular ball bearings. The frame carries the stator or field of the motor, a lubricating-oil sump, the hinged blower casing, air-intake control and burner air-nozzle. The hinges of the blower housing are attached to the plate, by which the burner is bolted to the front plate of the boiler.

PUMP PRESSURE VARIES WITH VISCOSITY OF OIL

As the pressure of the oil supplied to either type of burner is just sufficient to cause the oil to flow to the atomizing cup, under no pressure, it is possible to use large openings in the burners. For this reason, fine needle-point valves are omitted. The pressure carried on various oils varies with their viscosities. On the lighter oils from 1 lb. to 5 lbs. is generally sufficient, while on the heavier or 14° oils, the pressure ranges from 30 lbs. to 40 lbs. at the pump, but, in any case the pressure at the goose neck in the atomizing cup is zero.

In the alternating-current burner, the motor is totally enclosed by the frame. The section of the frame around the motor is cored so that the fuel oil may be forced around the motor, thereby cooling the motor and warming the fuel. Because of this cooling feature, and the impossibility for dirt to enter the motor, its life is greatly prolonged.

It sometimes is inconvenient to obtain electric current on an installation and for such cases, the Ray burner has been designed with the electric motor replaced with a steam turbine. Compressed air may be used in place of steam on these turbines to drive the burner while the boiler is being brought to pressure. This obviates the necessity of a stand-by boiler.

Office Building Heated By Two 25,000 Sq. Ft. Ray Burners

The alternating-current burner and the steam-turbine burners are both direct driven at 3400 R.P.M. This, of course, presents another problem for the direct current motor. This is easily overcome by using a 1700 R.P.M. motor and a 2 to 1 speed-up gear to the burner shaft.

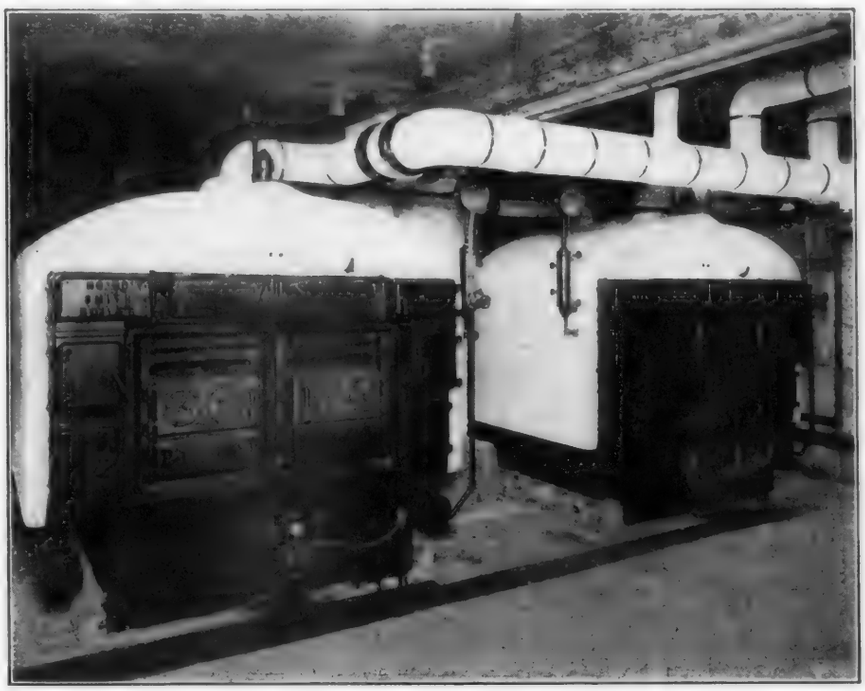
The hinge lugs on both the blower casing and furnace plate are drilled so that a common sleeve can be inserted. A pipe placed through this sleeve and connected through a packed-gland hinge joint to the fuel-supply pipe, makes it possible to swing the burner into or out of the firing position at will, without the use of tools.

Rigid pipe connections are carried from the hinge joints to the motor frame and from this to the fuel tube. The fuel tube then carries the oil through the center of the hollow motor-shaft to the atomizing cup at the inner end of the burner.

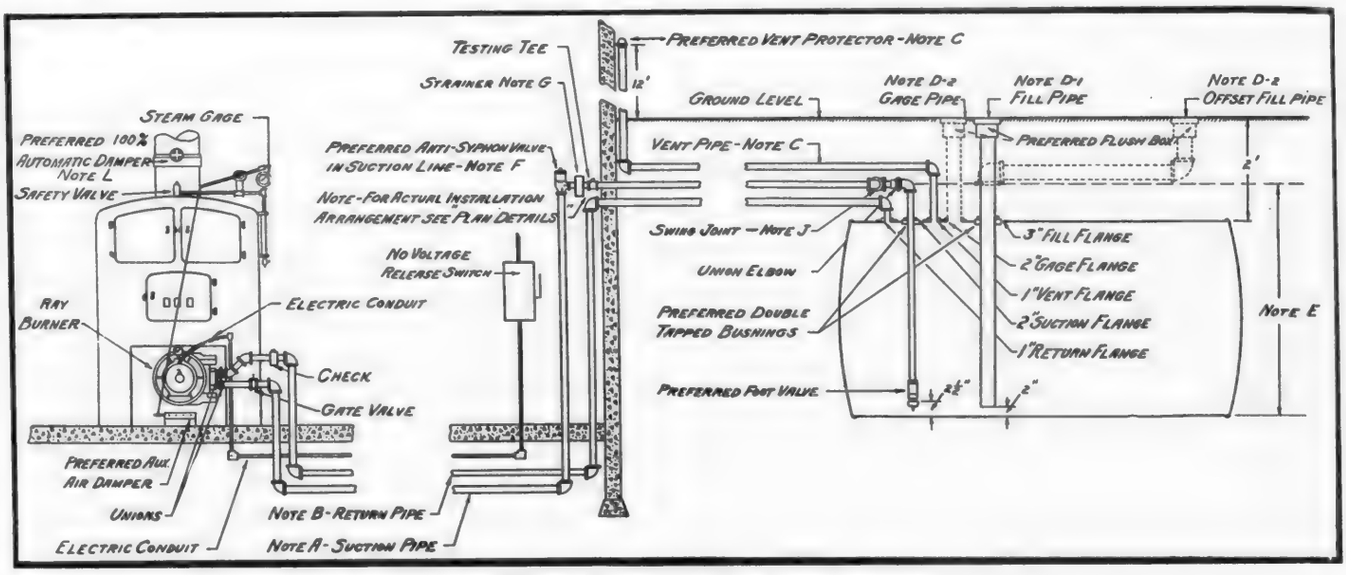
LUBRICATION AUTOMATIC FOR LONG PERIODS

Lubrication of the ball bearings is accomplished by the splash system. A bronze oil ring hangs on the shaft and dips into the oil sump. As the motor is rotated, the lubricating oil is thrown upward and into the ball bearings. Because of this continuous lubrication, the ball bearings have a very long life. Many of the original burners installed over ten years ago are still giving continuous satisfactory service with the original bearings.

The pump-type burner is similar to the non-pump burner, with the exception that a fuel-oil pump is built integral with the burner casing. This pump is driven by the burner motor through a worm-and-wheel reduction. In this case the worm wheel replaces the oil ring.



Typical Installation for Church Heating Plant



Piping Layout for Ray Burners

As the oil is delivered through the fuel tube to the positively-driven rotating cup, it forms a film on the inside of the cup through the action of centrifugal force. A slight flare on the inner sides of the cup causes the oil to be thrown off tangentially in the direction of rotation and across the front of the air nozzle which surrounds the cup.

The air nozzle is equipped with vanes which are set at an angle with the front of the nozzle. As the oil film is thrown tangentially off the edge of the cup, the air from the nozzle strikes it in the opposite direction. This produces a fine mist and insures each finely divided particle of oil being surrounded with sufficient air for complete and rapid combustion.

This angular vane nozzle also controls the shape of the conical flame so that the burner is adaptable to any shape of fire box. When the fire box of a boiler is long and narrow, a nozzle in which the vanes are more nearly parallel with the center line of the burner would be used. It often is necessary to build the fire box short and wide and in this case, the flame may be made to fill the entire box by using a nozzle in which vanes are set at a greater angle with the burner center line. These nozzle changes are made quickly and easily, as all nozzles are interchangeable with respect to the corresponding parts of the burner.

CONTROLS

Where the burner is to be operated between high and low limits, the ratio between the oil and air supplied for combustion is regulated by means of a simple four-arm linkage. The burner is set for the largest flame necessary to supply the maximum amount of heat. Then the ratio is set on the arms so that a progressively lower flame of the same quality is obtained until the minimum desired flame is obtained—the absolute minimum being about 25% of the maximum. In plants where it is desired to maintain a constant pressure, it is then only necessary to attach an arm of the linkage to the ordinary damper regulator.

This type of control is generally desired in large building or apartment house heating. In these instances it is usual to maintain a constant boiler-pressure and the damper regulator accurately controls the burner.

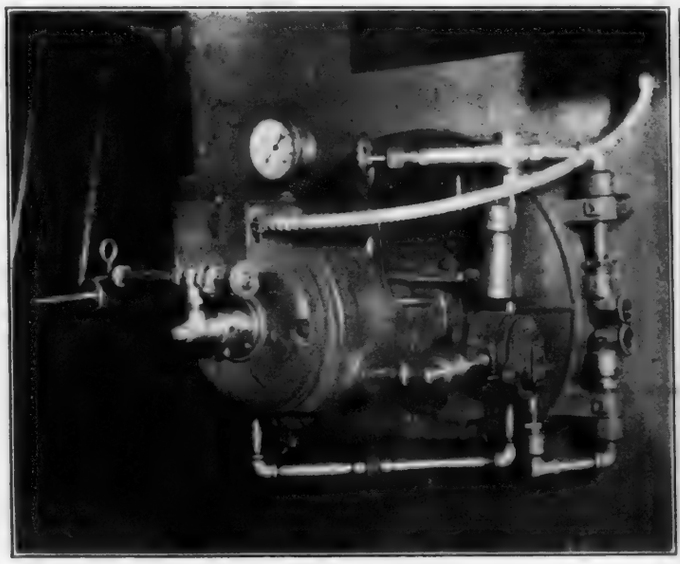
The full automatic, on-and-off, thermostatically-controlled burner can be used equally as well, however, where desired. In this case, the burner is equipped with Honeywell controls.

Ray burners also are designed to maintaintain a constant pressure on high-pressure steam boilers. This can be done either with the high-low or the on-and-off burner. With the high-low burner, the volume of flame is varied by means of the boiler pressure, while in the on-and-off type, the burner stops and starts at any predetermined pressures.

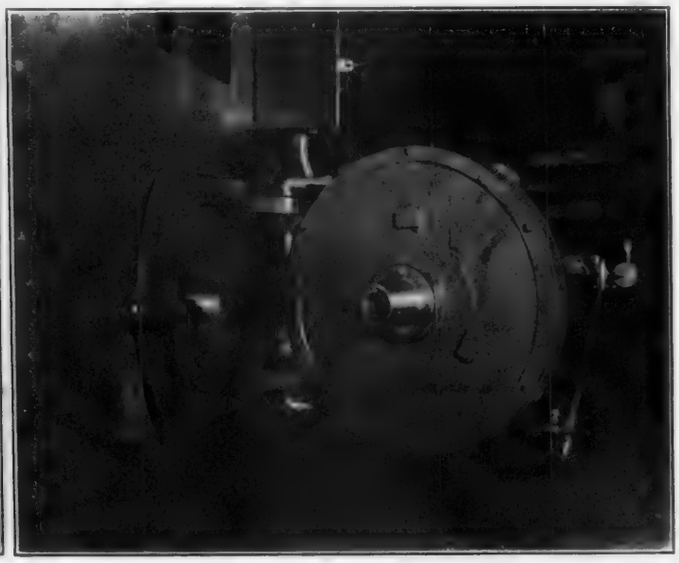
IGNITION

The ignition of a Ray burner may be either by means of a manually-ignited torch, electrically-ignited gas flare or by electric spark directly.

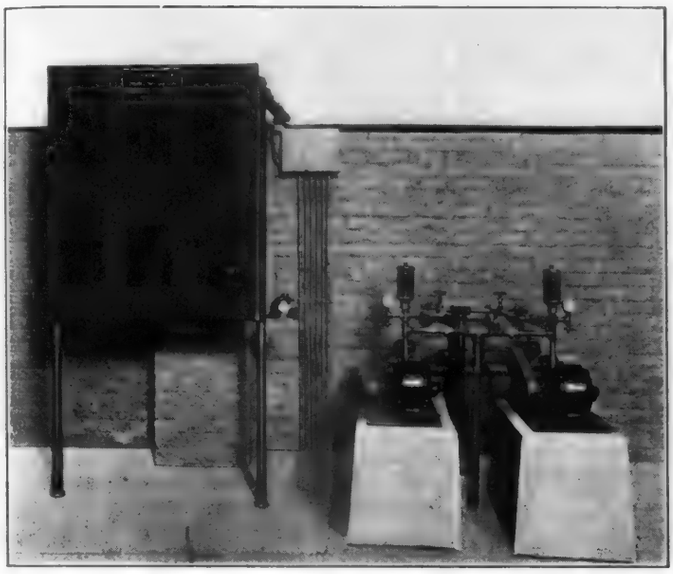
The automatic high-low flame controlled burners are ignited by means of a manually-ignited flare, while the



Ray Pump Type Burner



Nozzle and Low-Pressure Control



Ray Rotary Pump Set Installation

Equipment for Commercial Heating Plant

automatic on-and-off burners are ignited either through the electric-gas or the straight electric ignition method. In the latter type burner, the ignition is controlled by means of the Honeywell DSS control system.

SAFETY DEVICES

Wherever a non-pump-type burner is used with a separate pump set, the burner is equipped with an automatic cut-off valve. These cut-off valves are designed to stop the oil supply if the burner rotation should be stopped for any reason. As the pump of a pump-type burner is positively connected to the motor and atomizing cup, this obviously is not needed. Safety devices providing against flame failure, boiler overheating, and low water also are applicable.

SIZES OF BURNERS

Ray burners are made in over 30 different sizes. This range can provide for boiler ratings from 800 sq. ft. to 139,000 sq. ft. of steam radiation, in the non-pump-type. The pump-type burner is made in sizes to handle from 800 sq. ft. to 13,900 sq. ft. of radiation. All of these sizes are manufactured with the high-low controls for either high or low-pressure boilers.

The full automatic burners are made in sizes to fire boilers rated from 800 to 13,900 sq. ft. These burners can be obtained, also, in either the non-pump or pump type.

PUMP SETS

Where a battery of three or more burners is to be used, it often is advisable to use the non-pump burner. In this case separate pump sets must be used. These can be furnished in either chain or worm drive. The capacities of these pumps range from 45 to 400 gal. of oil per hour.

The Ray worm-drive pump set is unique in that it is totally enclosed except for the suction and discharge pipe openings. The motor is enclosed as is the case in the alternating current burner and the worm drive runs constantly in an oil bath. Wherever absolute quietness is desired, the worm-drive pump set can be used. In some installations, in industrial plants, the worm-drive pump set can be used to advantage, as it is impossible for dirt to get into the moving parts in any way.

GRADES OF OIL BURNED

All Ray burners, from the smallest to the largest sizes, are designed to burn the heaviest grades of oil. Industrial, or high-low type burners are listed by the Underwriters to burn 14° oil, preheated where necessary. The preheating temperature necessary for the burners is only the temperature needed to keep the oil in its fluid state.

This temperature will vary with quality of oil to be burned, but it is generally found that 80° F. is sufficient to keep any oil as a consistent fluid. Although the oil is naturally viscous, at this temperature, no difficulty is experienced in the pumping or burning. It has been found that Ray burners can be lighted and will maintain a fire with good combustion, when using most grades of 14°-16° oil at as low temperatures as 45°-50° F.

Any other grade of oil desired can be burned with equal efficiency. Where an oil which will flow freely at 20° F. is used, it is not necessary to apply any preheat. This oil may or may not be viscous, but this in no way affects the atomization of the oil by the burner or combustion.

INSTALLATION OF BURNER

To install the Ray burner it is only necessary to remove the grate bars. and line the former boiler ash-pit with a refractory brick. The burner proper is mounted in the place of the former ash-pit door.

In order that the burner will operate satisfactorily on the high-low principle, with comparatively little combustion noise, simple fire-box diagrams are available for various types of boilers. By means of these diagrams, the installation of the burner has been made very easy, so that it is possible quickly to convert a boiler to oil burning, in the coldest of winter weather.

PIPING

When a pump-type burner is used, the entire oil-burning equipment is mounted on the boiler front, for the pump is integral with the burner. The only other equipment necessary then is the oil storage-tank and piping. The oil tank may be of any desired capacity and conveniently located, within reasonable limits.

For any oil which will flow at 20° F., it is necessary to run only two pipes from the burner to the tank. One of these pipes will be the suction line from the tank. The other will be return from the burner pump to the tank to return the excess oil from the pump.

When any oil which must be preheated is used, it is then necessary to add a preheater in the suction line and thermometers for determining the oil temperature.

It is also advisable to install a heating coil in the tank, whenever the tank may be subjected to chilling. Hot water can then be circulated through this coil in the tank and the fuel oil kept above its congealing point.

PROTECT THE JOINT AND SAVE THE SETTING is the title of a little booklet issued by the Johns-Manville Corp., New York. This is a story of refractory cements and their function in joining refractory materials for boiler and other work and in providing definite protection of the joint. The booklet is well illustrated with examples of defective brickwork and of properly laid and finished jobs. Directions are given for applying Johns-Manville refractory cements, and several pages of technical data contain recommendations for various classes of application. Size 6 in. x 9 in. Pp. 22.

New Apparatus and Appliances

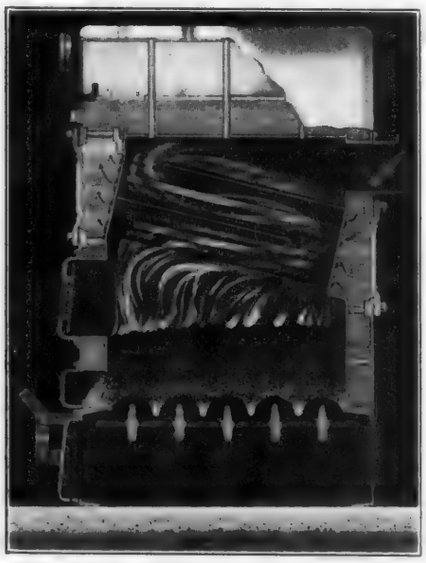
Knowlton "Watertoob" Steam Boilers

Based upon its experience of over 40 years in the boiler manufacturing field, Orr & Sembower, Inc., Reading, Pa., have brought out the new low-pressure heating boiler, built of copper-bearing steel. All seams of the boiler are electrically welded, thus fusing all plates into one solid unit. In this way, the possibility of leakage has been reduced to a minimum. By adding a small amount of copper to the steel used in the construction of these boilers, their resistance to corrosion has been increased proportionately. The manufacturers have been careful, not only to meet the requirements of the A. S. M. E. Boiler Code, but to exceed them in respect to the thickness of metal used.

In the construction of this boiler a number of arsenical copper tubes of small diameter are placed close together. This arrangement, it is pointed out, permits of more rapid heating absorption than would be possible with fewer tubes of large diameter. To further accelerate the water circulation, the copper tubes are set at an angle. The gases are forced to pass back and forth over the tubes by means of two baffles, each made in three pieces. As the tubes are expanded into place, they easily are removable in case of necessity. Special emphasis is placed on the adaptability of the Knowlton steel boilers for use with oil burners due to the copper tubes, the positive water circulation and the long gas travel.

Damper regulators containing a one-piece corrugated copper bellows are included in the boiler's equipment, as well as a manually-operated damper at the side of the boiler to permit the adjustment of the draft for different weather conditions and for the easy opening of the draft when firing.

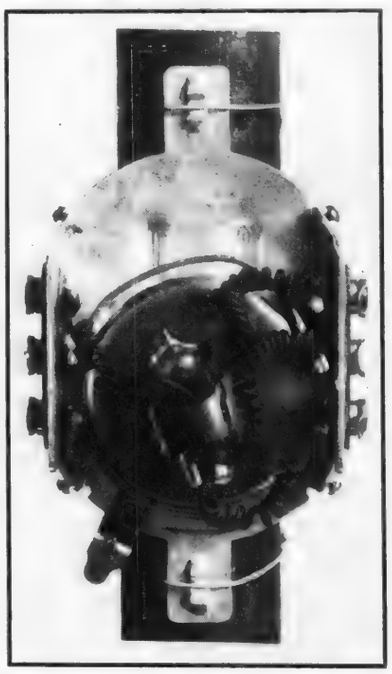
The boiler is made in six sizes, with steam ratings from 520 sq. ft. to 1820 sq. ft. and corresponding water ratings.



Circulation of Water and Gases in the Knowlton "Watertoob" Steel Boiler

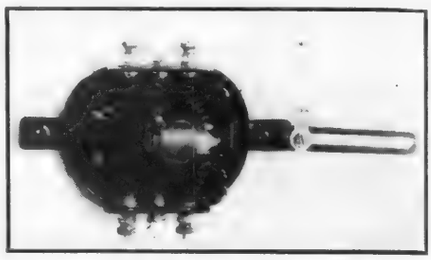
Additions to Honeywell Oil-Burner Control Equipment

To obviate the necessity for drilling through boiler walls in order to install an immersion-type aquastat, Honeywell



Honeywell Surface Aquastat Clamped Against Flow Main

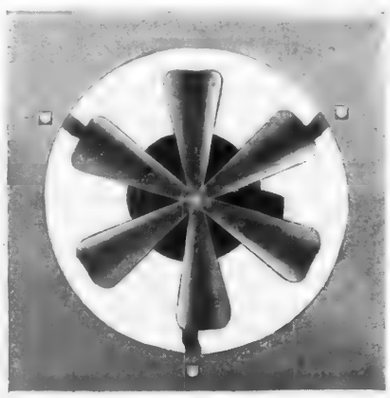
Heating Specialties Co., Wabash, Ind., has placed upon the market a surface aquastat, designed to be clamped against a flow main. Naturally this class of instrument does not operate with the same sensitiveness as the immersion instrument, this detriment being offset by extreme simplicity of installation. The surface aqastat is available for use in either high-voltage or low-voltage circuits, and can be used with or without a room thermostat. When used with a room thermostat, either the thermostat or the aquastat can operate to stop the burner at any time, but the boiler temperature must recede and the room thermostat be calling for heat before the burner again can start. An enclosed mercury switch is used, and the instrument can be set at any desired point within its range. For service in spring and fall, a setting below 140° is suggested, and when winter weather is experienced the setting can be advanced to the maximum permissible. Another new Honeywell control is the Vaportrol, designed to have a very precise actuation to shut off a burner when the pressure increases a few ounces only. It is particularly intended for Broomell and similar vapor systems, where the temperature is controlled by means of a boiler regulator integral with the system. The Vaportrol is mounted directly on the boiler regulator. As the pressure rises the boiler regulator operates the Vaportrol mercury switch. When the Vaportrol arm is raised far enough the mercury switch makes a circuit to the motor switch, causing it to stop the burner. As the pressure recedes the circuit automatically is broken, returning the control to the room thermostat. A special type of Vaportrol is available for use with the Mouat system, and is mounted on the regulator lever. Colored wires for each portion of the circuit make wiring simple.



Vaportrol—A Boiler Limiting Device for Vapor Systems

Small Blower for Warm-Air Furnaces

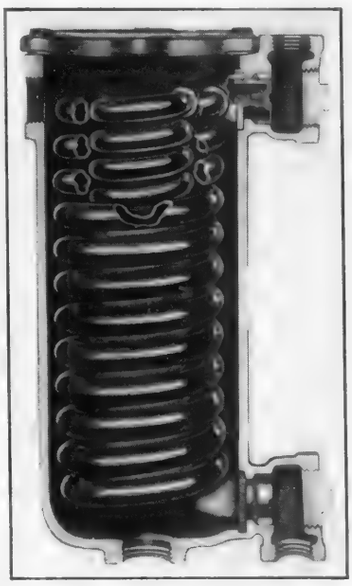
A motor-driven fan to be mounted in the cold-air duct of a warm-air furnace has been brought out by Autovent Fan & Blower Co., 1805 N. Kostner Ave., Chicago. The six-blade fan is driven by a heavy-duty motor having wool-packed bearings and requiring lubrication but four times a year. By means of this unit warm air can be forced to any desired room, regardless of exposure or excessive infiltration. In summer it can be used as a ventilating fan. Two sizes are available, one rated at 800 cu. ft. per minute, requiring an input of 70 watts, and one at 1200 cu. ft. per minute, requiring 105 watts. The smaller-size fan is driven at 860 r.p.m. and the larger at 1160 r.p.m. Either size can be quickly installed and electric connection made through extension cord and plug.



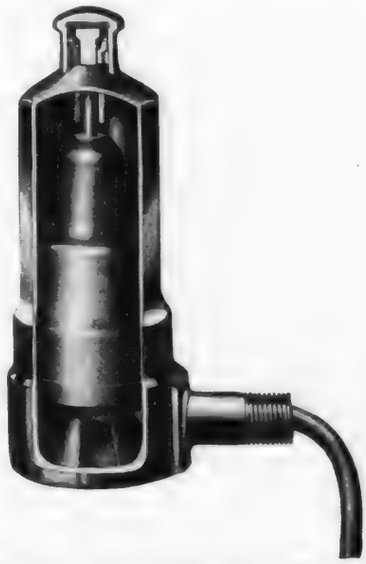
Autovent Fan for Use With Warm-Air Furnaces

Bell & Gossett Indirect Water Heater

Designed to provide domestic hot water by indirect heat from a steam or vapor boiler, the unit manufactured by Bell & Gossett, 3000 Wallace St., Chicago, brings to light several unique points of design and construction. The heater consists of a vertical cylindrical cast-iron shell, with an opening into one side near the top and one in the bottom, tapped for piping to the low-pressure boiler. A bolted-on cover plate is provided. The water coil of copper, either single or double, is enclosed in this casing, the inlet and outlet of the coil being through specially-designed connections, readily broken with a spud wrench. This feature is incorporated because of the necessity, in many localities, for cleaning scale from the heating coils. Instructions for removing the coil are cast into the cover plate. A special rotary hack-saw is provided where it is necessary to cut into the boiler when installing.



Water-Heating Coil in This Indirect Water Heater Is Readily Removable



Dole Air-Vacuum Valve for One-Pipe Steam-Heating Systems

Dole Puts Air Vacuum Valve No. 2 on Market

Announcement has been made by the Dole Valve Co., Chicago, of the No. 2 vacuum valve, for use on one-pipe steam heating systems. It is an air valve with an auxiliary piston which is designed to aid in quickly expelling the air from the radiator and preventing its return to the system. It is pointed out that the water, instead of having to be heated to the usual 212°, in this system vaporizes at approximately 160°. This combination, it is stated, minimizes the amount of firing to be done, and simulates the uniformity and silent operation of hot-water heat, together with the quick action of steam, producing an economical vacuum system.

Ideal Arcoblast Heater

SELLING OIL BURNERS is the title of a small folder issued by Williams Oil-O-Matic Heating Corp., Bloomington, Ill. The text matter was reprinted from the vocational guidance section of the Chicago Daily News, and is an interesting talk on the retailing of oil burners.

Arcoblast Extended-Surface Heaters Use Copper Tubes

Copper tubes, fin-wound with copper strips, are expanded into cast-iron headers in the Arcoblast heaters announced by the American Radiator Co., New York. The tubes are staggered and the extended surface is made an integral part of the tubes which are expanded into the headers with a special tool.

Each header is composed of two flanged elements, one being the tube sheet into which the tubes are expanded; the two are bolted together. The heater is noncorrosive, and is made in ten sizes. A newly-issued catalog features this series of heaters and gives all necessary roughing-in dimensions, physical data and performance data.

Warford—A New Oil Burner

Strongly influenced by its long experience in the automotive field, The Warford Corp., 42 Whitehall St., New York, is placing a domestic oil burner on the market. A conventional vacuum tank is used as a service supply, a carburetor-type adjustment for regulating the supply of fuel to the nozzle, and a two-cylinder Kellogg compressor and vacuum pump to handle the air. A ¼ H. P. General Electric repulsion-start induction motor furnishes power.

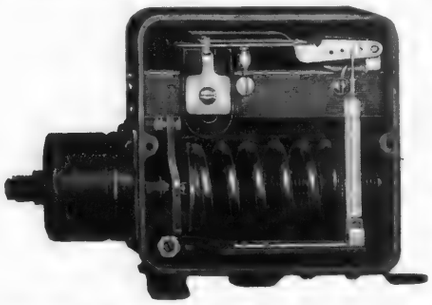
Electric ignition, with two terminals, each in a separate plug, is furnished by a Webster transformer. The nozzle unit is bolted to the fire door, and the piping can readily be disconnected in case it is desired to fire the boiler with coal. The pump, motor and Honeywell motor control, assembled in a single unit, are placed on the floor near the boiler.

Preliminary distribution will be handled by the already large Warford dealer organization. The burner will be manufactured in Syracuse.

Warford Domestic Oil Burner

New Trade Publications

PENN MAGNET SWITCH is described in a leaflet received from Penn Electric Switch Co., Des Moines, Ia. This device is designed to open or close an electric



Cutaway Penn Magnet Switch for Pressure Operation, Showing Construction Details

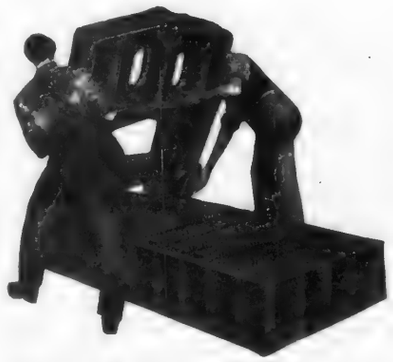
circuit with variations in temperature, pressure or vacuum, and is adapted to use with domestic refrigeration, oil burners, boiler control and many similar applications. A feature is the small differential necessary to cause functioning. When operating on temperature, a difference of 2° is sufficient, and as much as 8° can be provided for. As a pressure switch the differential can be anything between 1 lb. and 5 lbs. A permanent magnet is used in conjunction with a movable armature actuated by a sylphon bellows, adjustment being made by changing the tension of a spring working against the bellows. Only 1/32-in. motion of the bellows is required. It is stated that tests on these switches have been made where contacts were made and broken over a half-million times, with no appreciable wear. The circular contains full technical data and prices.

INSULATING EFFICIENCY is the subject of an attractive brochure prepared by the Armstrong Cork & Insulation Co., Pittsburgh. This is the first of a series, and is devoted to the story of roof insulation with corkboard. The illustrations are particularly effective, consisting of a number of photographs of actual installations, the corkboard being shown in its natural brown color. With each picture is a blue-print-type drawing showing the details of construction. In the text the value of corkboard as an insulator is told, and the heat-loss constants for different types of construction are given. Computations are made showing the fuel economies that are possible through the use of this roof insulation. A second bulletin deals with the determination of the most economical thickness for any given conditions and discusses the effect on ultimate cost. Bulletin No. 3 points out the necessity for moisture resistance in roof insulation and pictures tests that can be made to show the high degree to which corkboard is non-absorbent. These bulletins are uniform in style and size, and, as a cover design, feature a photographic reproduction of a block of corkboard in natural color.

LAKESIDE VENTILATING UNITS are described in a circular issued by the Lakeside Co., Hermansville, Mich. These units consist of multi-blade impeller fans, belt-driven by suitable electric motors. They are built in three sizes, rated at 3500, 18,000 and 25,000 cu. ft. per min. Casings and bearings are attached to welded angle-iron frames, SKF self-aligning bearings being used. The fan outlet is fitted with both vertical and horizontal deflectors, so arranged that the fan output easily can be directed in any direction. The drive is Tex-rope, the pulleys having from 1 to 4 grooves according to the load to be carried.

Impeller of Lakeside Fan, Showing Staggered Blades

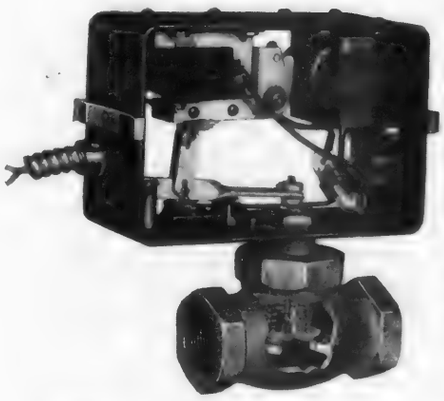
CABOT'S "QUILT" as a HOUSE INSULATOR is featured in a sheet issued by Samuel Cabot, Inc., Boston, for insertion in the American Gas Association's Industrial Gas Series Bulletin on House Heating. Data are given on the insulating qualities of this material and on the savings that may be expected through its use.



Installing Burnham Square Sectional Boiler

BURNHAM HANDBOOK OF ENGINEERING DATA is bound, with sectional catalogs of boilers and heating specialties, in a handsome loose-leaf cover, and issued by the Burnham Boiler Corporation, 30 East 42nd St., New York. The section on engineering data, consisting of 96 pages, contains a description of standard types of heating systems featured by this company, a method of determining radiation requirements, a section on leakage, data on concealed and indirect radiation, and miscellaneous useful information. No small part of the data, drawings, and curves used in this section were taken from THE HEATING AND VENTILATING MAGAZINE. A 36-page supplement, designated as Catalog SB1, is devoted to square sectional steam and water boilers, illustrating the salient features and presenting necessary figures showing installation requirements and boiler capacities. A similar section, Catalog No. 68, is devoted to the series of smokeless boilers; Catalog RB1 features round sectional boilers, while High-pressure hot water heating boilers are listed and described in Catalog HP1. Radiators of the Ferro type are the subject of Catalog R1 and specialties are gathered together in Catalog S1, of 36 pages. The general make-up is excellent, the data being lucidly presented, and the cuts and drawings, made especially for this publication, are noteworthy. This set of catalogs is produced in pocket size. 4½ in. x 7¾ in.

Applying Armstrong's Corkboard on a Flat Steel Roof



Time-O-Stat Snap Valve, Showing Working Parts

TIME-O-STAT CLOCK CONTROLS for gas water heaters are described in a catalog received from Time-O-Stat Corp., Milwaukee, Wis. These, and a comprehensive line of similar controls for incinerators and dryers, automatic storage heaters, gas ovens and gas-fired boilers and furnaces, comprise a highly developed series of devices, each filling a specific need. The Type B snap valve for gas-fired boilers, for example, can be used with any type of room thermostat, tumbler switch or electric limit control. The valve closes with a spring and does not depend upon gravity; it snaps shut in case of power failure. In case the pilot flame is extinguished the valve automatically closes, and if the electric supply is shut off a by-pass lever can be set to hold the valve open. When the current supply is restored the valve immediately comes under control of the room thermostat without manual setting. Current consumption is 25 watts when the valve is open; when closed no current is used. Other specialties in the same line are highly developed and the point is made that, while thousands are in use, there is practically no service requirement. In addition to several loose-leaf bulletins, each covering a single device, the Time-O-Stat catalog, No. 3, emphasizes the clock control for gas water heaters. Size 8½ in. x 11 in. Pp. 16.

ROBERTSON VENTILATION DATA BOOK, in its fourth edition, is being distributed by H. H. Robertson Co., Pittsburgh, Pa. The purpose of this publication is to present general information relating to ventilating problems, specifically to give the air-moving capacities of Robertson ventilators, and, through illustrations and text, to show how these ventilators have been installed to take care of a wide variety of ventilation problems. It is stated that three years were required in which to secure the technical information embodied in the many capacity tables presented. The four factors determining the capacities of roof ventilators are elucidated with the aid of well-drawn diagrams. A section entitled "How to Use the Robertson Ventilator Capacity Tables" explains the 15 pages of tabulation that follows. To exemplify the variety of applications of these ventilators and the manner in which difficult problems have been solved, more than 20 pages are filled with photographic illustrations and drawings, each with a few words of text. As an example of unusual application, is shown the interior of an electric sub-station, having a capacity of 20,000 K.W. It is said that this has the highest capacity per cubic foot of volume of any sub-station in the world, due to the removal of heat from the motor-generator sets, through huge metal casings and Robertson ventilators on the roof. The catalog is an excellent example of high-class engineering literature. Size 8½ in. x 11 in. Pp. 52.

Robertson Ventilators (14 of 72-In. Size) Pulling Smoke and Fumes From the Kiln Building of the National Brick Company, Maynard, Ind.

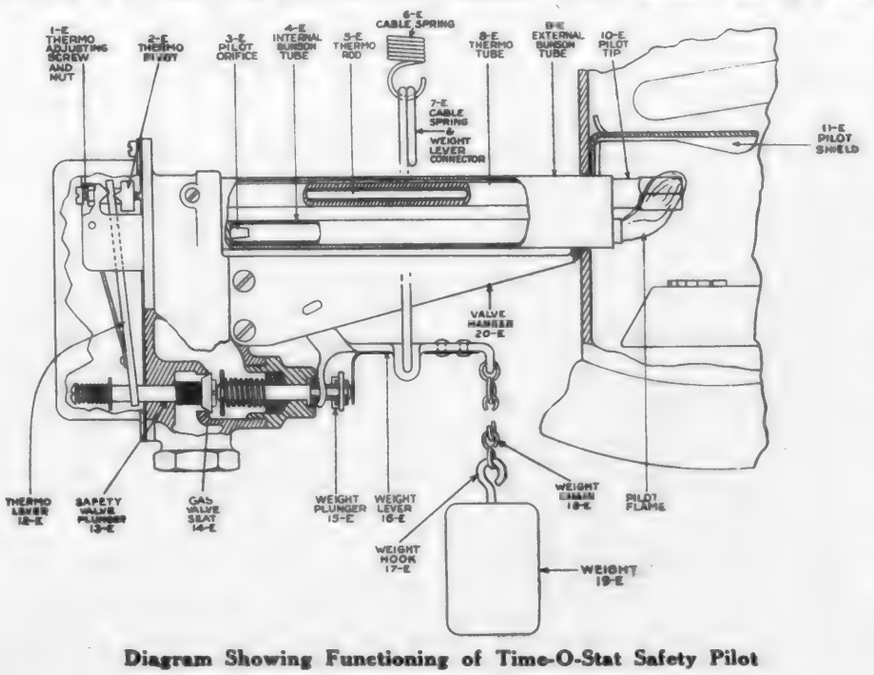
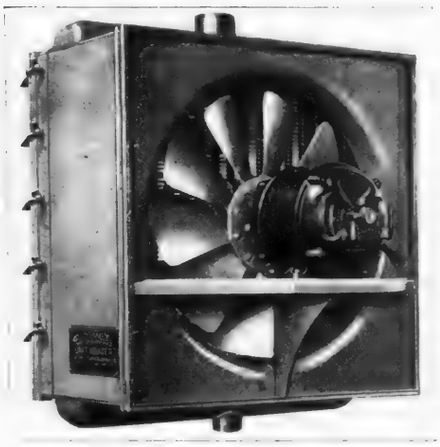


Diagram Showing Functioning of Time-O-Stat Safety Pilot

THE CHIEF ENGINEER SEES THE PRESIDENT is a unique and forceful brochure just received from The Brown Instrument Co., Philadelphia, Pa. This catalog is a first-class instance of the value of fine photographic work and extreme brevity in text in putting over a story. Every right-hand page in the pamphlet contains a large half-tone reproduction showing one of successive stages of contact between the chief engineer and president of a hypothetical company. There are seven words of text accompanying the first photograph, and not more than fifty in any case, while the left-hand pages either are entirely blank, or carry small half-tone reproductions of Brown electric flow-meters, pyrometers, CO_2 meters and thermometers. This catalog is an excellent sample of what can be accomplished by leaving much unsaid.

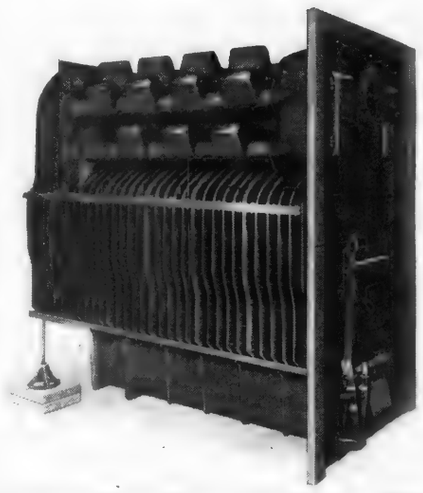
AIR-OUT SYPHON THERMOSTATIC AIR VALVES are described in a small folder issued by the New York Air Valve Co., 5 East Third St., New York. This is an all-metal, non-adjustable valve, operating on the diaphragm principle, and having an extra-size float. The base is heavy cast brass, polished, and the valve is so shaped as to fit into the new types of radiators.



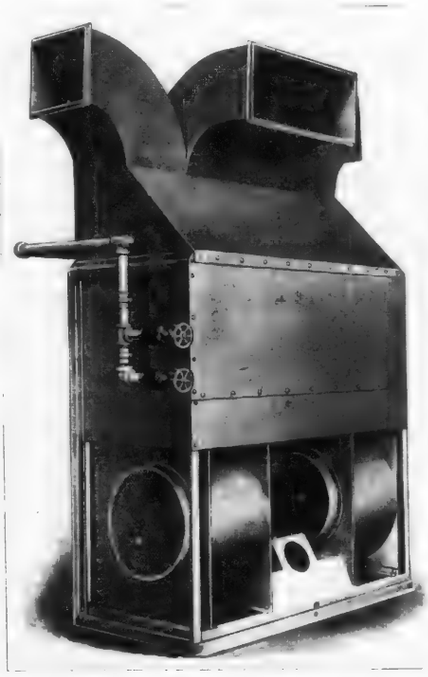
Overhead-Type Comet Unit Heater

THE SUPREME ACHIEVEMENT IN UNIT HEATERS captions a circular issued by The New York Blower Co., 2246 South Halsted St., Chicago. This features the details of design and construction of the Comet line of overhead and floor-mounted unit heaters which, the manufacturer states, are built to have a life equal to that of the heating system. The core is made of special steel, treated, inside and out, after fabrication, to be rust proof. It is said that the design has been so carefully worked out that the heat transfer is equal to that of lighter-weight materials having theoretically higher heat conductivity, but lacking the refinements of design. Fans having ten blades and built of extra heavy materials are used. The floor types are equipped with a recirculating door, permitting the gravity circulation of over 35% of the capacity of the unit when the fans are not running. Repulsion-induction oversize motors are used. Each heater unit is tested to 1000 lbs. hydraulic pressure. Overhead models are listed with capacities from 123,000 B.T.U. per hour to 482,000 B.T.U. per hour, and the floor models are rated at 469,000 B.T.U. to 1,008,000 B.T.U. per hour.

NATIONAL SYSTEM OF HOT-BLAST HEATING is comprehensively described in a catalog issued by Herbert H. Davis Co., Inc., 4146 South Wabash Ave., Chicago. This equipment is designed for installation in schools, theaters, factories, and similar types of buildings, and consists, essentially, of a rectangular horizontal type of warm-air furnace for coal or oil firing, with a motor-driven fan forcing air over the heating surfaces. The combustion chamber is heavily ribbed, and the products of combustion are passed through two tiers of tubular passages which form a secondary radiator. Streamline sections are used where possible. Seven sizes of heaters are standard, rated at equivalent capacities of 3000 sq. ft. to 9200 sq. ft. of steam radiation. The catalog is voluminously illustrated with general and detail plans of school buildings, theaters and factories, showing the methods of installation. One typical industrial installation, pictured and described, is a monitor-roof manufacturing plant occupying 242,000 sq. ft. of floor space, and having an hourly heat loss of 20,083,000 B.T.U. This is heated by 11 National units. The catalog also features complete data on a test made at the Central School, Wausau, Wis., where two batteries of seven units each are installed. This plant, on a 24-hour test, showed an efficiency of 71%, and provided heat at a cost of $0.0835 per pupil, with coal at $7.90 per ton. The catalog is completed with a presentation of pertinent engineering data and with standard specifications covering National equipment. Many graphs are shown, from which performance can be visualized. Size 8½ in. x 11 in. Pp. 54.



National Direct-Fired Unit Heater With Casing and Blower Removed, Showing Ribbed Combustion Chamber and Extensions to Upper Tubes



Floor-Mounted Unit Ventilator of the New York Blower Company

YOU CAN HEAT BEST WITH GAS—USING CLOW GASTEAM appears on the cover of an interesting catalog received from James B. Clow & Sons, 201 N. Talman Ave., Chicago. In this publication advantage has been taken of literature prepared, from time to time, by the various branch offices of the company, and the greater portion is filled with illustrations of buildings of all kinds in which this equipment has been installed. This presentation is striking and "puts over" the fact that Gasteam radiators have a wide range geographically and in application. These radiators have been on the market for 27 years and consist of a rather conventional type of radiator in the base of which is a miniature combustion chamber and gas burner. It is stated that, where there is not excessive humidity in the atmosphere, it is safe to make installations without vent connections, the water formed by combustion aiding in making a more desirable atmosphere. The catalog illustrates several methods of using these units and features the seal of approval of the A. G. A. Testing Laboratory. Size 6 in. x 9 in. Pp. 24.

Chicago Produce Market, Largest in the World, Heated by More Than 600 Gasteam Radiators

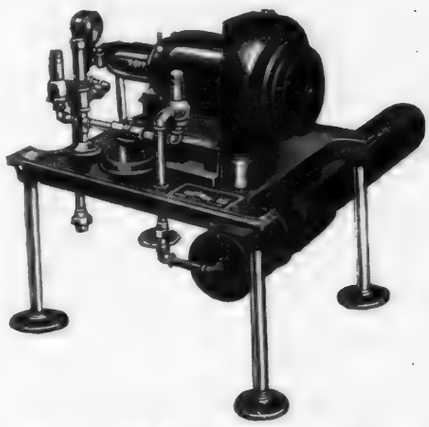
Present Accepted Practice in Domestic Oil Burners

Rickard. *Mechanical Atomization, Mechanical Draft, Electric Ignition*

Previous articles in this series are:

1. *Kleen Heet*, July, 1925.
2. *Baker*, July, 1925.
3. *Kerrihard*, July, 1925.
4. *Silent Glow*, August, 1925.
5. *Aetna*, August, 1925.
6. *Caloroil*, September, 1925.
7. *Oil-O-Matic*, September, 1925.
8. *Chalmers*, October, 1925.
9. *Hart*, October, 1925.
10. *Sun*, October, 1925.
11. *Rayfield*, November, 1925.
12. *A. B. C.*, November, 1925.
13. *Electrol*, December, 1925.
14. *Grant*, January, 1926.
15. *Nu-Way*, January, 1926.
16. Wayne, February, 1926.
17. *May*, February, 1926.
18. *Ray Rotary*, March, 1926.
19. *Super Oil Heator*, May, 1926.
20. *Nokol*, July, 1926.
21. *Johnson*, August, 1926.
22. *Arrow*, September, 1926.
23. *Safe Fire*, October, 1926.
24. *Sword*, November, 1926.
25. *Hardinge*, January, 1927.
26. *Petro*, February, 1927.
27. *Sundstrand*, March, 1927.
28. *Northern*, May, 1927.
29. *Vesta*, June, 1927.
30. *Marr*, July, 1927.
31. *Aladdin*, August, 1927.
32. *Remington*, October, 1927.

33. Rickard



Rickard Oil Burner With Cover and with Cover Removed

ALTHOUGH a comparatively newcomer in the field of domestic oil burning, the Rickard burner manufactured by the Rickard Engineering Corp., 535 Fifth Ave., New York, is the design product of an engineer with an extensive experience in this industry and a first-hand knowledge of the weak and strong points or contemporaneous oil burners.

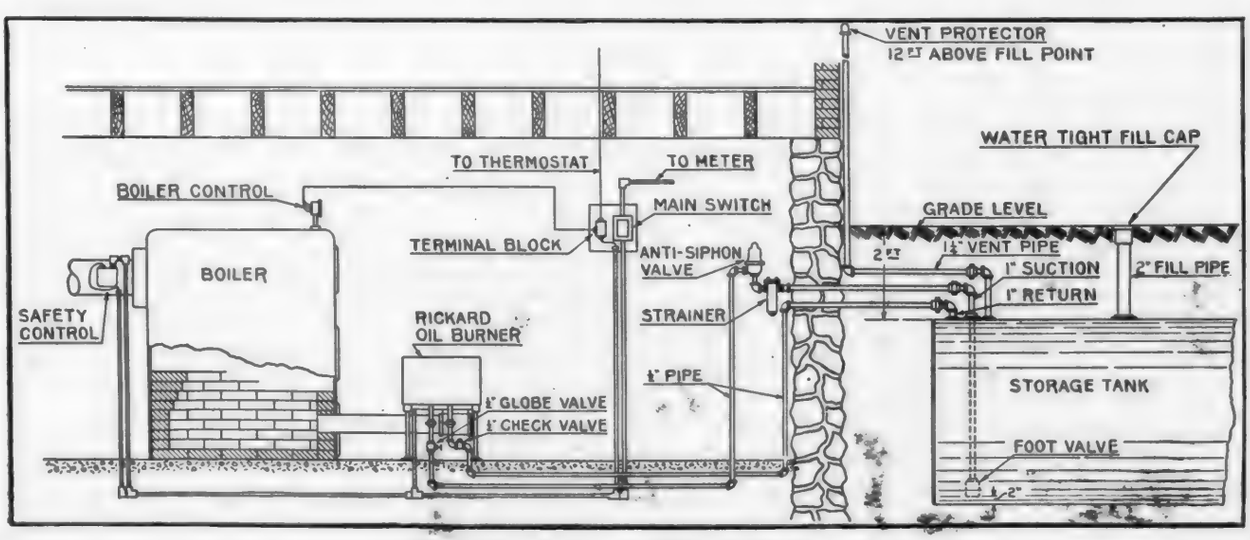
Simplicity of design and ruggedness of construction are outstanding features. Standard equipment and parts easily obtained in almost any location are used, and there is an absence of delicate elements.

The burner is of the mechanical-atomizing type, using a large tube to convey air from a low-pressure blower to the combustion chamber. It is installed through the ash-pit door opening, which is bricked and cemeted so that the only opening to the ash-pit is the air tube. The burner assembly is built up on a cast-iron bed plate, raised from the floor on pipe legs. A sheet-metal cover fits down over the unit and air is drawn to the blower through openings in the base of the bed plate.

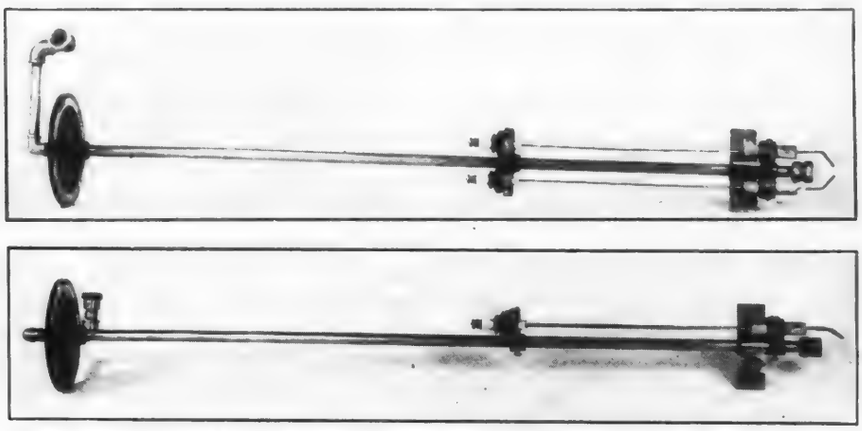
HOW OIL IS HANDLED

Oil is drawn directly to the burner from the underground storage tank and is discharged through the atomizing nozzle by a Viking pump, direct-connected to one end of the motor shaft. After passing through a primary strainer and the pump, oil is forced through a second strainer with 200 mesh—so fine that no particle passing through it can clog the orifice in the nozzle. The pump has a capacity considerably greater than the maximum demand upon the burner, and excess oil is by by-passed, through a relief valve, to the tank. An anti-drip valve, set slightly below the pressure at which oil is fed to the nozzle, prevents oil reaching the nozzle before the proper pressure has been built-up, and insures a clean cut-off when the burner stops. A pressure of 100 lbs. to 125 lbs., depending upon the oil characteristics, is used.

The oil pipe connecting the anti-drip valve and the nozzle extends along the axis of the air tube, passing through a plate at the outer end of the blast tube.



Typical Installation of Rickard Oil Burner



Two Views of Oil Gun, Showing Arrangement of Nozzle and Electric Ignition

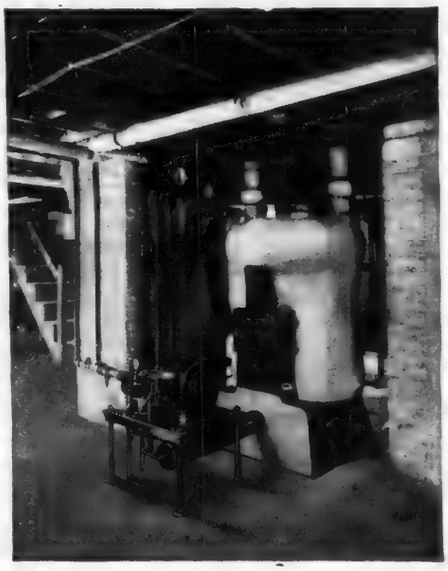
By taking out four screws and breaking a union, the pipe, nozzle and ignition points readily can be removed for inspection. Design of the nozzle embodies two, four or six tangential slots cut in the metal of the nozzle head, and an orifice of proper diameter for the desired burner output. This follows long-established practice in marine oil-burning, and it is said that this nozzle, with the 200-mesh screen, is almost non-clogging.

AIR FOR COMBUSTION

A standard Sirocco blower is used to supply a large volume of air at low pressure. This and the oil pump are driven by a 1/6 H. P. Janette motor of completely enclosed type. A feature is the lubrication system, requiring oiling but once a season. At the inner end of the air tube, and forming a support to center the oil tube and the atomizing nozzle, is a set of vanes designed to swirl the air in the opposite direction to the rotation of the oil spray. The result is a thorough mixing of the oil-mist and air, tending to complete combustion.

IGNITION

Electric ignition, in the form of a flaming arc, is provided, again with standard equipment—a Webster transformer. Two leads are taken from the transformer to the ignition points, forming a complete circuit and minimizing radio interference. Ignition wires are heavy and extend almost the entire length of the air tube, the moving air in which effectively prevents heating. The arc may be maintained throughout the operation of the burner, or it may be set to continue for only a predetermined time after each start. The terminals are so set as to be just within the zone of the nozzle discharge, and it is said that this location minimizes trouble from carbonization.



Typical Installation of a Rickard Oil Burner

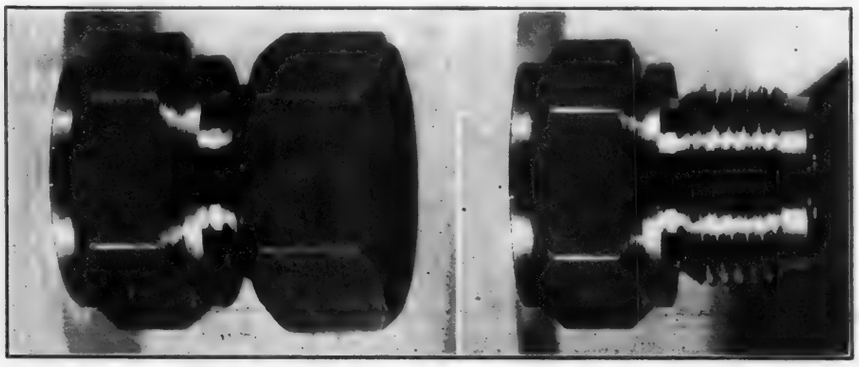
CONTROLS

Honeywell room thermostat, of the plain or clock type, low voltage motor switch, combustion control and boiler safety-control are used. The combustion control prevents the pumping of oil to the burner in case of ignition failure, and requires manual setting after clearing up the difficulty.

CAPACITIES

A single size of burner is built, on a production basis, and four nozzle-sizes, with corresponding adjustments of air supply by means of a blower damper, make possible proper firing of heating boilers ranging from the smallest sizes up to those of 5000 sq. ft. rating.

Rickard burners are listed by the Underwriters' Laboratories to burn oil fuels not heavier than 28° A. P. I.



Two Views of Atomizing Nozzle, One With and One Without Cap

STATEMENT OF THE OWNERSHIP, MANAGEMENT CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, OF THE HEATING AND VENTILATING MAGAZINE, published monthly at New York, N. Y., for October 1, 1927.

State of New York, County of New York, ss.:

Before me, a notary public in and for the State aforesaid, personally appeared Arthur S. Armagnac, who, having been duly sworn, according to law, deposes and says that he is the editor of The Heating and Ventilating Magazine, and that the following is, to the best of his knowledge and belief, a true statement of said publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in Section 411 Postal Laws and Regulations printed on the reverse of this form to wit:

1. That the names and addresses of the publishers, editor, managing editor, and business managers are:

Publisher, Heating and Ventilating Magazine Co., 1123 Broadway, New York.

Editor, Arthur S. Armagnac, 1123 Broadway, New York.

Managing Editor, None.

Business Manager, Gustave Petersen, 1123 Broadway, New York.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given).

Heating and Ventilating Magazine Co., 1123 Broadway, New York.

Arthur S. Armagnac, 1123 Broadway, New York.

Gustave Petersen, 1123 Broadway, New York.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more or total amount of bonds, mortgages, or other securities are: None.

4. That the two paragraphs next above giving the names of the owners, stockholders, and security holders, if any, contain, not only the list of stockholders and security holders as they appear upon the books of the company, but also in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustee, hold stock and securities in a capacity other than of a bonafide owner and this affiant has no reason to believe that any other person, association or corporation has any interest direct or indirect in the said stock, bonds or other securities than as so stated by him.

ARTHUR S. ARMAGNAC, Editor.

Sworn to and subscribed before me this 16th day of September, 1927.

A. L. SCANTLEBURY,
Notary Public, New York.
(My commission expires March 30, 1929.)

DEXTER HORTON NATIONAL BANK BUILDING
SEATTLE, WASHINGTON

Architect: John Graham, Seattle
Consulting Engineer and Heating Contractor: Hugh Phelps, Seattle
Building Manager: Charles E. Horton

Powers Control
Costs Less in the Long Run

Annual bills for repairs and adjustments of temperature control will have no place in the budget of the Dexter Horton National Bank, of Seattle. Architect, Consulting Engineer, and Building Manager joined in eliminating that needless expense. They installed the POWERS system of Automatic Temperature Control. Realizing that "first cost" is only a relative factor, they figured the "upkeep" as well, for experience shows that the POWERS trouble-free system insures from 20 to 30 years of accurate and dependable control, without the need of frequent adjustment or the constant expense of "service".

For convincing evidence to support the above claims, read our book, "The Elimination of Heat Waste". Sent free on request.

The Powers VAPOR DISC Thermostat

This remarkable thermostat gives *absolute* graduated control, uses but 10% of the compressed air required by other systems. Good for 20 to 30 years of *accurate, dependable* control, without frequent repairs or adjustments.

THE POWERS REGULATOR CO.

36 years of specialization in temperature control

2718 Greenview Avenue, Chicago

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Baltimore	Cincinnati	El Paso	Los Angeles	New Orleans	Rochester	CANADIAN OFFICES:
Boston	Cleveland	Hartford, Conn.	Louisville	New York	St. Louis	Toronto Winnipeg
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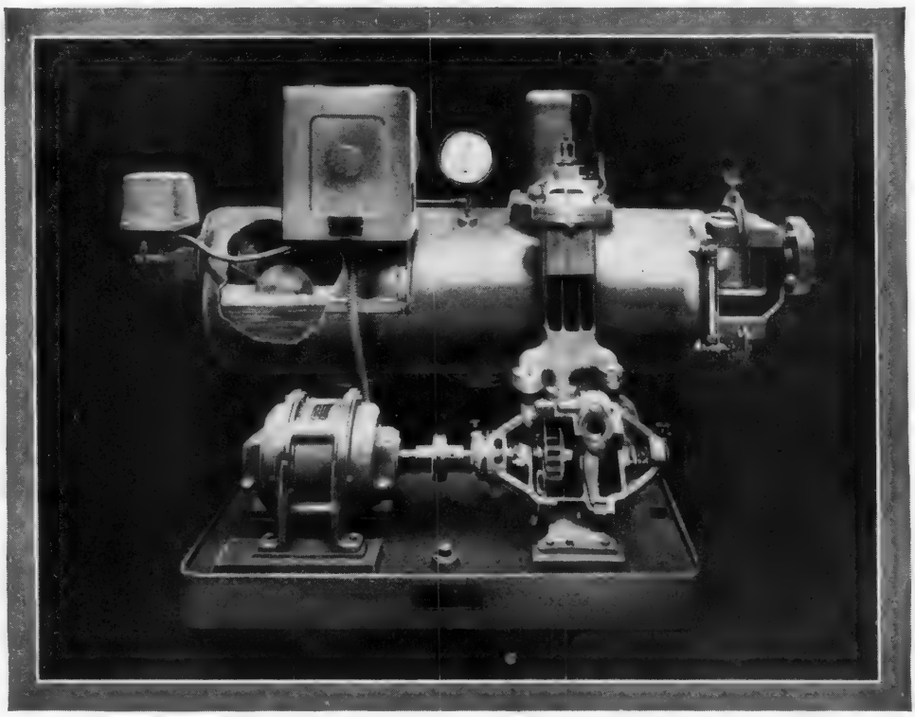
Charlotte, N. C.	Detroit	Kansas City	Nashville	Portland	Seattle	(3844A)



Two motors with automatic control —or one?

Ask the engineer who has run a Jennings Vacuum Heating Pump and he will say one motor.

The Jennings Pump, with automatic control, consists of an air pump and a water pump, mounted on the same shaft and combined in a single casing. It is driven by one motor, with a self-starter actuated either by the returns float switch or by the vacuum regulator.

Compare this simple, compact construction with an outfit consisting of separate water and air pumps. Such equipment has eight bearings to take care of. Just twice as many as the Jennings Pump. It also has two motor starters against one for the Jennings Pump. When the heating system has wet returns, the two motor outfit, with separate pumps individually controlled, is at a still greater disadvantage.

NASH ENGINEERING COMPANY

81 Wilson Road **SO. NORWALK, CONN.**

Branch Sales Offices: Atlanta, Birmingham, Boston, Buffalo, Chattanooga, Chicago, Cleveland, Dallas, Denver, Detroit, Indianapolis, Kansas City, Memphis, Miami, Minneapolis, New Orleans, New York, Omaha, Philadelphia, Pittsburgh, Portland, Richmond, St. Louis, Salt Lake City, San Francisco, Seattle, Tampa, Washington, D. C. **In Canada:** Montreal, Toronto and Vancouver. **European Offices:** London, Eng., Norman Eng. Co.; Brussels, Belgium, and Amsterdam, Holland, Louis Reijners & Co.; Oslo, Norway, and Stockholm, Sweden, Lorentzen & Wettre.

Jennings Pumps

RETURN LINE AND AIR LINE VACUUM PUMPS CONDENSATION AND CIRCULATING PUMPS

Trade and Miscellaneous Notes

Coming Events

November 30-December 1, 1927. Mid-year meeting of the National Warm-Air Heating and Ventilating Association at Urbana, Ill. Headquarters at the Urbana-Lincoln Hotel.

December 1-3, 1927. Sixth annual convention of the American Construction Council at St. Louis, Mo. Headquarters at the Statler Hotel.

December 5-9, 1927. Annual meeting of the American Society of Mechanical Engineers in New York. Headquarters at the Societies' Building, 29 West 39th Street.

December 5-10, 1927. Sixth National Exposition of Power and Mechanical Engineering in New York. Headquarters at the Grand Central Palace.

January 23-26, 1928. Annual meeting of the American Society of Heating and Ventilating Engineers in New York. Headquarters at the Hotel Pennsylvania.

Miscellaneous Notes

Trade Extension Bureau sponsored the first regional meeting in St. Louis, at the Coronado Hotel, September 13. The object of the meeting was to inform the manufacturers, wholesalers, salesmen, heating contractors, and master plumbers of the bureau's enlarged program and suggestions were given for getting the greatest possible benefit from it. E. L. Flentje, of the bureau, spoke on "The New Competition and Its Far-Reaching Effects on Modern Industrial Life." He stressed the fact that competition within an industry is being discussed at such length that the more important competition between industries is being overlooked to the detriment of all within the heating and plumbing industries. He also stated that the bureau was formed for the purpose of placing these industries in a position to combat and overcome the inter-industry competition for the consumers' dollars and that, in recognition of the intensified inter-industry struggle, the bureau has broadened its program materially, comprehending national advertising and an intensification of public relations work and existing services of the bureau.

A. B. Pierce, of the N. O. Nelson Mfg. Company, spoke on the subject of "What the National Trade Extension Bureau Means to Us." L. A. Rickly, of the American Radiator Company, delivered a talk on "The Part the Salesman Plays in Industry Promotional Work."

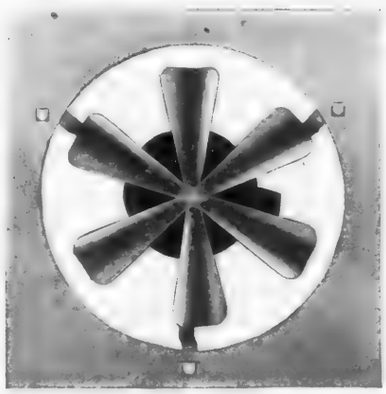
At the afternoon session the speakers included Judge Fred L. English, representing the Heating and Piping Contractors Association of St. Louis, who spoke about winning confidence by guaranteeing work. He cited many specific instances of how successful the guarantee has been as operated by his association.

The committee in charge of this meeting was composed of W. L. Clucas, chairman, Thomas Gale, Jere Sheehan, F. N. McGrath, A. B. Pierce, L. J. Dubuque, Jr., secretary. The bureau is contemplating a series of such meetings during the coming year.

Eastern Supply Association, at its annual meeting at the Hotel Astor, New York, October 12-13, elected the following officers: President, R. A. Tate, Utica Plumbing Supply Co., Utica, N. Y.; first vice-president, James A. Messer, James A. Messer Co., Washington, D. C.; second vice-president, Joseph A. Maynard, Boston Brass Co., Waltham, Mass.; secretary-treasurer, Frank S. Hanley. Directors: W. A. Brecht, Hajoca Corporation; Willard C. Chamberlin, Standard Sanitary Mfg. Co.; Leo M. O'Neil, M. O'Neil Supply Co.; J. F. Sheppard,

Autovent's New Furnace Fan!

Forced Air Circulation



Easy to Install

Long Life . . . Quiet . . . Dependable

We announce the new AUTOVENT FURNACE FAN! NEW—in its entire design. NEW—in its surprising quietness. NEW—in its freedom from vibration. NEW—in its sturdy, long-life qualities. Many, many new things about this fan. And lastly, NEW—in its *Sales Opportunities!*

For complete data ask us to send Bulletin 75.

AUTOVENT FAN & BLOWER CO.

"Over 11 years of GOOD fans"

1805-1827 No. Kostner Ave. **CHICAGO**

C. S. Mersick Co.; A. A. Tomlinson, Tomlinson Co.; A. M. Behrer & Co.; Edward Smolka, E. Smolka Plumbing Supply Co., and William G. Schafer, W. G. Schafer Co. Claude Owen, president of the E. G. Schafer Co., Washington, D. C., again was chosen councilor to the United States Chamber of Commerce.

Among the speakers at the meeting were Cecil W. Farrar, president of the Excelso Products Corp., Buffalo, N. Y., who supplemented his views on modern merchandising methods under the title, "Throwing Out the Price Book by Selling 'Living Comfort;'" Dean John T. Madden, of New York University, whose subject was "Some Problems in Modern Distribution;" Martin J. Beirn, general sales manager of the American Radiator Company; L. W. Johnson, of the A. M. Byers Co., Pittsburgh; Walter J. Kohler, president of the Kohler Company, and Russell G. Creviston, recently appointed secretary of the T.E.B. Program and Budget Committee.

Mr. Johnson, in discussing the wrought-iron pipe situation, stated that business was practically the same in volume for the fiscal year, ending September 1, as it had been for the previous year. He looked for a possible recession in business for the next few months. The steel business, Mr. Johnson stated, was operating at 60% of its capacity which was slightly less than in 1926. Wages have been reduced somewhat in the pipe industry, and low inventories are the rule.

Conditions in the boiler and radiator industry, according to Mr. Beirn, have been about on the same level for the first eight months of the year. At present. radiator shipments were slightly lower and boiler shipments higher. Mr. Beirn urged a campaign of education along merchandising and marketing lines for the contractors, and advised manufacturers to make a careful study of the number of actual building projects, rather than the volume of building construction in dollars and cents. For the first eight months of the year, he stated, the number of building projects was 1.5% greater than for the same period last year.

Casin W. Obert, for the past 16 years secretary to the Boiler Code Committee of the American Society of Mechanical Engineers, has resigned to associate himself with the Union Carbide and Carbon Research Laboratories, Long Island City, N. Y. Mr. Obert, in view of his long years of work with the committee, has been persuaded to remain a member of it. As a token of appreciation and esteem the members of the committee presented Mr. Obert with a 23-jewel Hamilton green-gold silver-faced watch with an engraved expression of sentiment. The committee passed a resolution appointing him honorary secretary to the Boiler Code Committee. Mr. Obert was formerly secretary of the American Society of Heating and Ventilating Engineers.

National Association of Plumbing and Heating Salesmen, Detroit section, held its regular monthly business meeting and dinner at the Barlum Hotel, Detroit, October 6.

Ara Marcus Daniels, Denrike Bldg., Washington, D. C., consulting and advisory engineer, announces as his professional associates, Cheston Fox Smith and Thomas Harold Urdahl. Mr. Smith will assist in fuel-conservation analyses, heating and power-plant economic surveys, advisory and recommendatory reports, and technical editorial writings, and will be in direct charge of special sales-service representation. Mr. Urdahl will assist in combustion analyses and heating and power-plant operating studies, and will be in direct charge of heating and ventilating plans, specifications and drafting service for architects, heating contractors, builders and owners.

A. E. Mosely, mechanical engineer of the Sloan Valve Co., 4300 West Lake Street, Chicago, won the contest for a slogan, which was conducted by the Power Transmission Association. Mr. Mosely's winning slogan is "Drive Right," and was the unanimous choice of the judges. It was stated that no slogan could have put into words more accurately the entire spirit of the new Power Transmission Association, which will hold its annual meeting at the Hotel Commodore, New York, December 7, at which meeting the final design and emblem embodying the slogan will be adopted.

Second Industrial Exposition will be held in Passaic, N. J., November 16-19, under the auspices of the Central Supply Co., Inc., of that city. The exposition will be open every day from 4:00 P.M. to 10:30 P.M., and the public will be admitted free. Reservations now are being made for exhibits, and facilities for mechanical devices, tables, chairs, etc., will be available.

Detroit, Mich.—Miss Margaret Irene Evans, daughter of Mr. and Mrs. Ira Nash Evans, was married to Edward Earl Baby, October 3. Mr. Evans was formerly a resident of New York where he was well known in heating circles.

Charles T. Phillips, consulting engineer, San Francisco, Cal., has completed plans and specifications for the electrical, heating, ventilating, plumbing and fire protection for the Fox Theatre, now being erected in San Francisco. The electrical and mechanical contracts will total over half a million dollars. The theatre will be one of the finest in the country and will seat approximately 5000 persons. Thos. W. Lamb, of New York, is the architect. The building is being financed by the Bancitaly Corporation and will cost about two million dollars.

Alliance Tank Co., Cleveland, O., announces an increase in authorized capital stock from $60,000 to $95,000. This company was organized May 19, 1926, under the laws of the State of Ohio, for the purpose of manufacturing steel tanks and miscellaneous plate work by means of the Lincoln "Stable-Arc" welding process.

New Firm

Samuel B. Shearer, 240 E. State St., Columbus, O., has opened an office as manufacturers' representative. Mr. Shearer formerly represented Warren Webster & Company in Columbus.

MANUFACTURED WEATHER
makes
"Every day a good day"
Humidification · Dehumidification
Heating · Ventilation · Purification
Drying
Carrier
Engineering Corporation
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SEE OUR DETAILED DATA IN ASH&VE. GUIDE

No Servicing Troubles with Sylphon Automatic Control of Service Hot Water

Sylphon TRADE MARK

OF COURSE, you want to guarantee to your customers a constant supply of hot water automatically maintained at the right temperature at minimum cost—*that builds your reputation.* But when you can in addition assure yourself of never having to service the automatic control of any service hot water system you install—*that builds up your profits.*

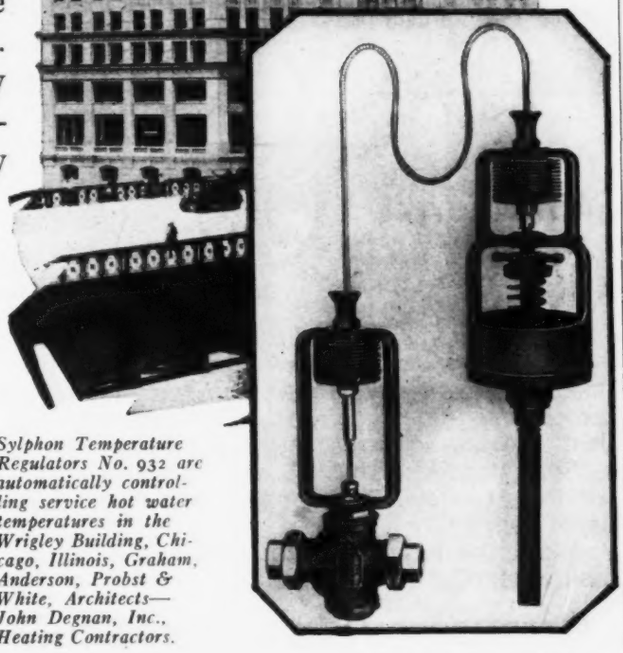
Assure Yourself and Your Customers of Equal Satisfaction

Sylphon Temperature Regulators generate within themselves the power for operation. Once installed and set they will automatically maintain the desired temperature without further attention or repairs, outliving in many cases the life of the heater.

Send for a copy of circular WTR-110 giving details of the profitable application of Sylphon Automatic Temperature Control.

This can be done hundreds of thousands of times—
AND NO APPRECIABLE LOSS OF FLEXIBILITY WILL DEVELOP IN THE ALL METAL SEAMLESS SYLPHON BELLOWS
Sylphon

All genuine Sylphon instruments contain as motor element the well-known Sylphon bellows—the most flexible, durable, sensitive and accurate expansion unit known.



Sylphon Temperature Regulators No. 932 are automatically controlling service hot water temperatures in the Wrigley Building, Chicago, Illinois, Graham, Anderson, Probst & White, Architects—John Degnan, Inc., Heating Contractors.

Sales Offices in:
New York, Chicago, Detroit, Boston, Philadelphia and in all principal cities in U. S.

The Fulton Sylphon Company
Originators and Patentees of the Sylphon Bellows
Knoxville, Tennessee, U.S.A.

European Representatives:
Crosby Valve & Engineering Co., Ltd., 41-42 Foley Street, London, W.I., England.

Canadian Representatives:
Darling Bros., Ltd., 120 Prince Street, Montreal, Canada.

Manufacturers' Notes

Gorton & Lidgerwood Co., 96 Liberty St., New York, has appointed Martin F. Cuff as its sales representative for the Gorton single-pipe vapor heating system in Union County, New Jersey. Mr. Cuff's headquarters are at 106 Summit Road, Elizabeth, N. J.

Modine Mfg. Co., Racine, Wis., announces the opening of four new foreign branches for distribution of its Thermodine unit heater. Representatives appointed are S. G. Leach & Co., Ltd., 26-30 Artillery Lane, London, Eng.; Asano Bussan Co., Ltd., Tokyo Kaijo Bldg., Tokyo, Japan; George Findlay & Co., Cape Town, South Africa; A. G. Hill, 45 Jarvis St., Toronto, Can.

Lincoln Electric Co., Cleveland, O., has appointed E. A. Thornwell as its representative for Georgia and eastern Tennessee, with headquarters at Atlanta, Ga.

Landon Radiator Co., North Tonawanda, N. Y., announces the appointment of Samuel Moore as vice-president. In 1900 Mr. Moore became connected with the American Radiator Company and since that time has been manager of several plants of that company. He was at one time general manager of plants for the National Radiator Co., Johnstown, Pa. R. C. Moffett has been appointed sales and engineering representative for the Central New York State territory. Mr. Moffett has been connected with the heating industry for the past 15 years, and until recently was in charge of the same territory of the American Radiator Company. His headquarters will be at 1682 Dudley Ave., Utica, N. Y.

Reed Air Filter Co., Louisville, Ky., announces that D. R. Maitland, formerly of the Wagner Electric Co., St. Louis, has been appointed factory superintendent, and A. T. Doud, formerly superintendent of the Brown Instrument Co., Philadelphia, has been appointed works manager. Another announcement made by this company is that it is completing a factory addition which doubles the present floor space. Occupancy is expected the latter part of October.

Yeomans Bros. Co., 1433 Dayton St., Chicago, announces the appointment of Dempster Mill Mfg. Co., Amarillo, Tex., as representative in northwestern Texas, to handle the complete Yeomans line.

Bryan Steam Corp., Peru, Ind., has opened a Chicago office at 228 North LaSalle St., with J. M. Knox as local manager. This office will be known as Bryan Boiler Sales. Sales will be handled independent of the home office at Peru, and boilers will be warehoused in car lots in Chicago for immediate delivery to the Chicago trade.

Commonwealth Brass Corp., Detroit, Mich., has promoted Peter Tazelaar to the position of sales manager with headquarters at the home office in Detroit. For the past eight years Mr. Tazelaar has represented the company in the New York territory.

Kennedy Valve Mfg. Co., Elmira, N. Y., announces the appointment of R. J. Flanagan, formerly Elmira district representative, as manager of its Chicago sales office and warehouse. J. T. Connelly has been transferred to Elmira from the Cleveland sales office, and W. E. Blake will succeed Mr. Connolly in Cleveland.

Weil-McLain Co., Chicago, and Michigan City, Ind., has purchased eleven acres of property, also the Miner-Morse drawn steel plant of Erie, Pa., where it will construct a new foundry. Work will commence in the near future, and it is stated that 250 men will be employed in this new foundry.

Changes of Address

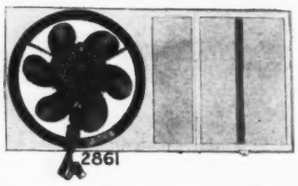
Rickard Engineering Corp., New York, manufacturer of oil burners, has moved its general offices and display room from the Fisk Building to larger quarters in the new Delmonico Bldg., Fifth Avenue at 44th Street. The manufacturing plant has been moved from Brooklyn to a new modern fire-proof factory building in Long Island City. It has been announced that the capital of the corporation has been greatly increased, and the Rickard oil burner has been approved by the Underwriters' Laboratories.

Robert June, industrial advertising service, of Detroit, announces the removal of his offices from 2208 W. Grand Boulevard, to the General Motors Bldg.

For The Home Kitchen

Emerson Ventilators

With Transparent Panels



EMERSON 9-inch and 12-inch ventilators are now available with adjustable metal mounting panels with pebbled glass inserts—no obstruction of daylight. This removes the last objection to the use of a fan in the window.

Solid panels and wall boxes with automatic shutters can also be supplied with 9 and 12-inch fans.

Write for latest Bulletin listing these fans and mounting accessories.

THE EMERSON ELECTRIC MFG. CO.

2018 Washington Ave., St. Louis, Mo.

806 W. Washington Blvd. Chicago, Ill.

50 Church St. New York City

BUILT TO LAST

EMERSON MOTORS *and* **FANS**

SPLIT-PHASE POLYPHASE DIRECT CURRENT

REPULSION START INDUCTION

P-H-I-L-L-I-P-S

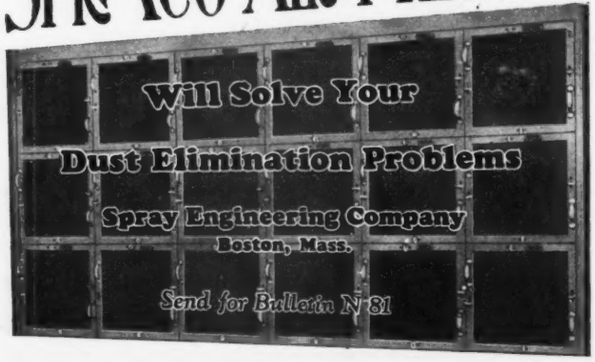
Self-Drilling Expansion Shells

Quick, economical and reliable for fastening equipment to concrete walls, ceilings, floors, beams and columns. Have internal U. S. Standard threads for rods, bolts and screws. Quickly installed by hand or with Phillips Spring Hammer. Every shell makes its own hole. No drills required.

PHILLIPS DRILL COMPANY

1537 Cortland Street Chicago, Ill.

SPRACO AIR FILTERS



Jack: "Now that we've got the plagued system finished, I wonder how many joints we'll have to replace when we test it out."

Old Timer: "Don't worry, boy. They sent us Grinnell Fittings this time. Their threads are right."

The Old Timer Knows

One of the big economies in using Grinnell Cast-Iron Fittings is sharp, clean-cut work. Many a time, when the water, steam or air is turned on not a single section of pipe has to be backed out to replace a leaky fitting. See for yourself. Try out some Grinnell Fittings on one job and you'll be quick to note the difference. If your own jobber doesn't stock them, write us for the name of the nearest distributor. Address your inquiry to Grinnell Company, Inc., 280 West Exchange St., Providence, R. I.

GRINNELL
PIPE FITTINGS

Cast Iron Fittings—Adjustable Pipe Hangers

GRINNELL

Pipe Bends—Welded Headers—Lap Joints—Piping Supplies

WANTED

Advertisements under this heading, $2.00 per inch, payable in advance. A 1-in. advertisement contains 35 words. To secure insertion copy must be received not later than the 20th of the month preceding date of issue.

AGENTS WANTED—By a well-known manufacturer of ventilating equipment of exceptional merits. Only men who already have experience in this line should communicate. Unusual opportunity for right, energetic men. Address Box 114, care of Heating and Ventilating Magazine.

WANTED—By a nationally-known manufacturer and distributor of vapor heating specialties, sales engineers for several districts in mid-west and the east who have a high grade clientele among the architects and heating contractors, coupled with proven ability to make heating plans, marked sales ability and of high moral character, to sell vapor heating specialties and systems on a most liberal commission basis. A rare opportunity as a side line to men possessing these requirements and who already maintain an office. With your application please give your present line of business, the territory you cover, experience and age. Address Box 112, care of Heating and Ventilating Magazine.

MANUFACTURER'S REPRESENTATIVE—Manufacturer of complete line of fans, air washers and unit heaters, desires recognized representatives on commission basis. Address Box 113, care of Heating and Ventilating Magazine.

POSITION WANTED—Heating, ventilating and power engineer. Available January 1. Twenty years' experience as engineer, sales engineer and manager. Well acquainted with good clientele in New England territory. Substantial and permanent connection desired. Address Box 115, care of Heating and Ventilating Magazine.

POSITION WANTED—Oil burner engineer, two years' experience as production manager and three years in development work. Has specialized in combustion and mechanical problems and can point to definite results accomplished as well as patents issued and applied for. Only reliable and well-financed firms considered. References cheerfully exchanged. Address Box 111, care of Heating and Ventilating Magazine.

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—through our complete and masterful instruction and personal guidance.

The **technical** man wins. After all, success is application, properly directed. **This hits you** right between the eyes! Turn the hours you spend **non-productively** into **real productive** hours. Let us guide you in a course of home-study, easily and comprehensively laid out, **that will not fail to bring you to the very top of your chosen field!** Foremanship! Ownership! Real success! **It lies with you, and you alone!** Check and mail us the craft you wish to master and we will send you full information as to how we can increase your earning power from three times on. There's no **limit!**

- ☐ Heating and Ventilating Engineering.
- ☐ Special Steam and Water Heating.
- ☐ Scientific Warm Air Heating.
- ☐ Plumbing and Sanitary Engineering.
- ☐ Contracting and Estimating.
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DISTRIBUTORS WANTED—After more than a year of constant development work, we are announcing a new popular-priced, quiet-running furnace fan. Distribution channels now being organized. Here is a specialty that is in demand everywhere. Write AT ONCE for descriptive literature, discounts and re-sale proposition. Autovent Fan & Blower Company, 1809 No. Kostner Avenue, Chicago, Illinois.

Liquidation of Machinery

1—No. 9 Sturtevant Blower.

2—No. 7 Sturtevant Blowers.

1—No. 6 Sturtevant Blower.

1—No. 4 Sturtevant Blower.

1—No. 2 Sturtevant Blower.

2—General Electric Turbo Blowers with 30 H.P. A.C. Motors attached, Switches, Panels, etc.

6—Dry Back Scotch Type Boilers. Built for 125 H.P. Each with Individual Stacks and Fittings. Built for 125 lb. Pressure. Suitable for Heating Purposes. First Class Condition.

The Continental Iron Works
West and Calyer Sts., Brooklyn, N.Y.

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HORIZONTAL AND VERTICAL AUTOMATIC ELECTRIC

Condensation Pumps

A thorough investigation of this pump will reveal the best material, the finest workmanship, resulting in a noiseless, rugged, reliable product that will give dependable service for many years.

For automatically returning condensation to boilers from low pressure gravity steam heating systems.

Also manufacturers of Bilge Pumps, Centrifugal Pumps, Sewage Ejectors, Sewage Pumps, etc.

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1421 Dayton St., Chicago
Representatives in all principal cities

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RADIATOR HANGER

FOR every tube-type radiator made there is an E-Z Hanger to fit it. All types in stock in principal cities.
Quick shipments.

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